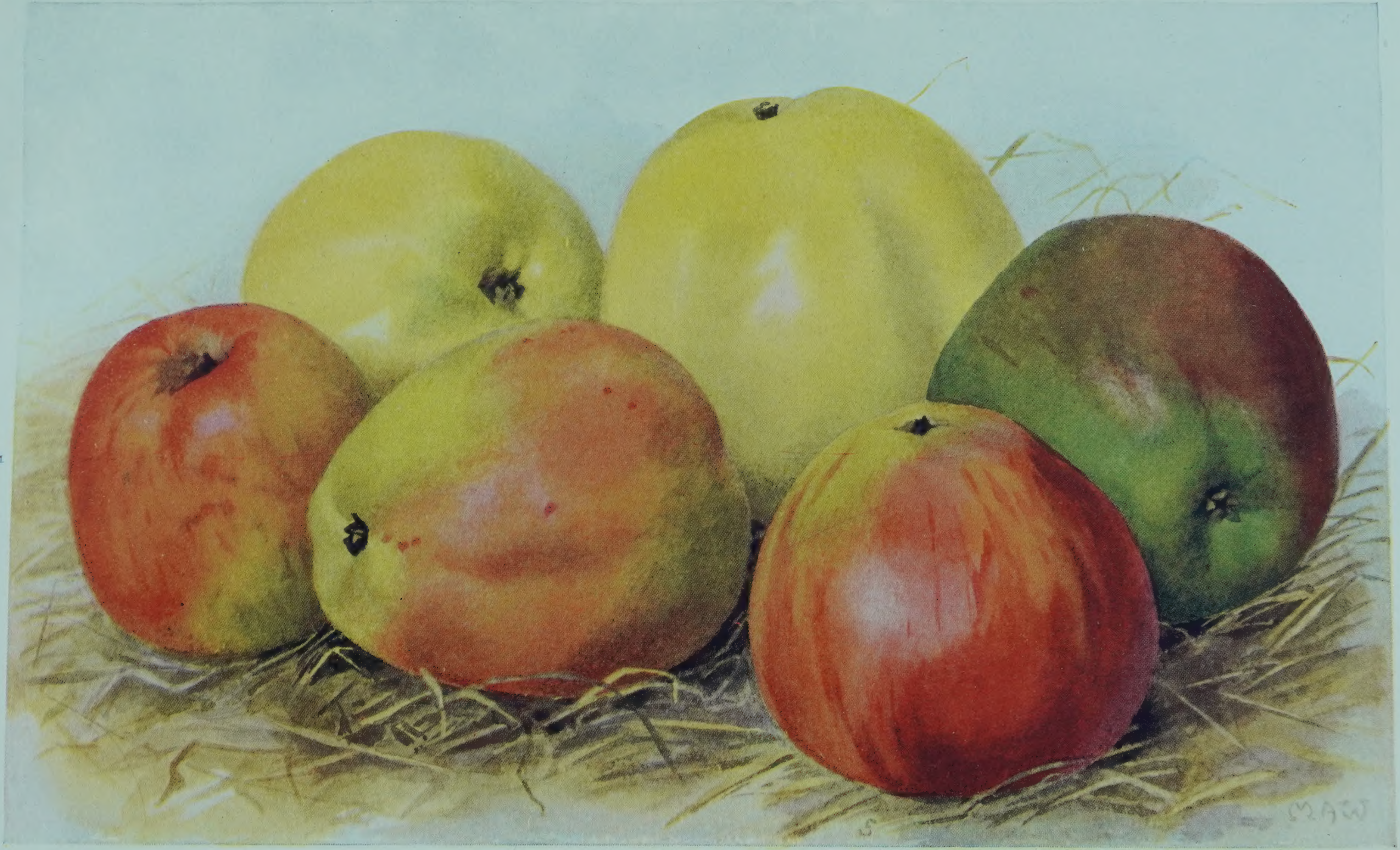
Commercial Gardening



A FEW GOOD MARKET APPLES

1. James Grieve. 2. Early Victoria. 3. Lord Suffield. 4. Lane's Prince Albert. 5. Golden Spire. 6. Worcester Pearmain.

COMMERCIAL GARDENING

A PRACTICAL & SCIENTIFIC TREATISE FOR MARKET GARDENERS · MARKET GROWERS · FRUIT FLOWER & VEGETABLE GROWERS · NURSERYMEN ETC.

By Many Practical Specialists
under the Editorship of

JOHN WEATHERS

Author of "A Practical Guide to Garden Plants"
"French Market Gardening" "The Bulb Book" &c.

In Four Volumes: Fully Illustrated

VOLUME III

THE GRESHAM PUBLISHING COMPANY
34–35 Southampton Street Strand London
1913

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SECTION XV

Commercial Fruit Growing

§ 1. INTRODUCTORY

The change that has come over the public estimate of fruit and vegetable growing for market is great enough to make one who remembers "things that were" rub his eyes in astonishment. "Has it come to this?" was the greeting of a schoolmaster to a former pupil on suddenly discovering him, after leaving school, aproned and trimming parsnips on his father's market garden. Emma Jane Worboise, in one of her stories, to signify the downfall of her heroine, says, she even married a market gardener! Now everyone seems to be crowding into the calling. It is astonishing how many families there are with a son who *must* have an open-air occupation; and none other appears to rise to the surface on the parental mind except market gardening. Now is the time for charlatans with impudence and a glib tongue to fleece the unwary by taking pupils to teach them a science they themselves do not know, and to practise an art they themselves have never mastered. It may be taken as a well-used modern maxim: "When you fail to make your market garden pay, *take in* pupils"! He who chooses market gardening for a calling may be sure of three things: a healthy life; a calling of varied interest, never fully learnt; plenty of real hard work. It may also be set down as a certainty that he will never make a fortune *at* market gardening.

A market garden may be wholly devoted to the cultivation of vegetables and flowers, or fruit, or a mixture of all three may be grown. The considerations that decide the course to be adopted will be: (*a*) the size of the holding; (*b*) the terms on which the holding is held; (*c*) the nature of the soil; (*d*) the market to be courted; (*e*) the knowledge or preference of the cultivator. This much, however, is clear at a glance: the grower of fruit only will have certain seasons of the year when there will be little to occupy his energies, and he will be most dependent upon the moods of our beautifully variegated climate. The first fact will be seen to have an intimate connection with the labour problem; for it is needless to point out that the necessity of employing casual labour for certain seasons only, and then casting it adrift, is depending upon a set of social conditions so bad for the labourer and for society at large that they must be got rid of if the fabric is to be preserved.

The fact is not lost sight of that the slack time of one trade may coincide with the busy time of another, and that many men manage to fit a spell of fruit picking into a busy year, of which a considerable part is occupied in other directions. Notwithstanding this, it remains unquestioned that a fair prospect of continuity of employment is necessary if you would have your men take an interest in their work. What trade is there in the whole gamut in which such an interest on the part of the employees is more desirable than that of the growing of fruit? The second fact mentioned above will be seen to have a direct bearing upon the commissariat of the grower. On an average, until we succeed in bringing our climate to heel, the grower may reckon that in two years out of five there will be little or no fruit. Unless during the years of plenty he has sat with profit at the feet of Joseph in Egypt, he will find himself in the position of those familiar occupants of an Irish cabin, where it is said streaky bacon is made by alternations of good feeding and its antithesis. There are certain kinds of flowers that seem to do well with vegetables, and many a market gardener has found his Wallflowers, his Stocks, or his spring-flowering bulbs do as well as any of his crops.

To deal with the fruit plantation first. Here a definition is much needed. When is a fruit plantation an orchard, and when is it a fruit garden? It is time the term "orchard" were restricted to plantations of fruit trees with the grass growing under, and where no cultivation takes place. Where an under crop of bush fruit or flowers is grown, and the ground is cultivated, it is a "fruit garden".

The first question that comes to anyone contemplating making a plantation is, what shall be the size of the holding? To answer it for anyone else is almost as difficult as to tell one about to marry what size of house to take. A great deal must depend upon the resources of capital he is able to control. Two rules may be laid down which must be like the laws of the Medes and Persians if happiness is to ensue: (1) Never take a larger holding than your capital can work easily, and have some capital to spare; (2) if your capital is borrowed, be sure the lender has a patience that will stand testing. A man whose ambitions go beyond having a pound a week to spend, and who proposes to depend upon fruit alone, must not start with less than 10 ac., and for this he ought to be able to see his way clear to £500 capital. The following figures, which refer to a plantation of 30 ac. of Dwarf Apple trees planted close and with no crop under, may be useful:—

		£	s.	d.
1st Year.	Cost of 10,250 Dwarf Apple trees at 50s. per 100	256	0	0
	Manuring 30 ac. at £10 per acre	300	0	0
	Ploughing, sub-soiling and preparing for planting	60	0	0
	Planting	42	0	0
	Cultivation for the year	60	0	0
	Rent at £2 per acre, and taxes	75	0	0
		793	0	0

		£	s.	d.
2nd Year.	Interest at 5 per cent on £793	39	13	0
	Cultivation for the year	60	0	0
	Rent and taxes	75	0	0
	Brought down	793	0	0
		967	13	0
3rd Year.	Interest at 5 per cent on £967	48	7	0
	Cultivation	60	0	0
	Rent and taxes	75	0	0
	Pruning	15	0	0
	Brought down	967	13	0
		1166	0	0

On the third year, if the trees were of the right sorts and in the right place, there would be, perhaps, fruit to the value of £4 to £5 per acre.

If the spaces between the rows had been cropped, the same amount per acre might have been secured in addition each year, although the cost of cultivation would have been somewhat increased; but the point is that in three years close on £40 an acre had been invested, and this without allowing anything for equipment, establishment expenses or household expenses. It would probably be the fifth or sixth year before sufficient return could be expected to cover outgoings, and by that time the capital invested would have been considerably added to. [W. G. L.]

§ 2. SITE FOR A FRUIT GARDEN

Having secured capital, or arranged for its supply, whither shall the intending grower direct his steps in order to secure a suitable site? He will find certain districts where fruit growing seems more than a fashion, almost a craze, and he may reflect that something especially suitable must exist either in soil or climate, or both, to account for such aggregations of capital and cultivators interested in one form of production, and he may feel bound to follow the crowd. If he reflects further, however, he may come to the conclusion that an instinct which investing human nature shares in common with the monkey has quite as much likelihood of being the reason. One successful man is sufficient to account for a host of imitators who doubtless imagine his success due to some magic in the spot, and who probably themselves achieve success in so far as they are able to acquire like skill and emulate his energy and forethought.

There can be little doubt that fruit will thrive in many parts of the kingdom where its cultivation has not yet been attempted for commercial purposes.

So far as soil is concerned, a few general directions must be observed. It is necessary to avoid land liable to flood or that is water-logged, for such land is inimical to fruit culture.

Low-lying land, or land in the neighbourhood of marshes, should not be chosen, because it is in such places that spring frosts do most damage.

Heavy cold clays should also be shunned. All kinds of fruit prefer warm light land and good drainage, though not too much of the latter or the trees may be punished in times of drought.

Two feet of sandy loam on a chalk subsoil has been described as the ideal land for fruit culture. It must be kept in mind that two results are sought in the planting of a fruit tree, viz. the growth of the tree and the production of fruit. It is possible to have the conditions so much in favour of the first that handsome trees only are the result; while if, on the other hand, the fruit-bearing qualities are encouraged too quickly, a fully developed plantation cannot be obtained.

The advancement of the science of agricultural chemistry now enables the grower, by means of analysis, to ascertain definitely what are the constituents, and in what proportions they exist, in any soil. Such an analysis should be obtained before deciding upon any site. The following analysis was given by Mr. C. W. Wise, in a paper read by him before the Royal Horticultural Society in 1895, as that of a soil (presumably at Toddington in Gloucestershire) in which he says: "Plums, Apples, Pears, Strawberries, Black and Red Currants, Raspberries and Gooseberries, all grow exceedingly well".

ANALYSIS

Silica or silicates insoluble in acids	74·20	per cent.
Oxide of iron and alumina	15·90	,,
Lime	·51	,,
Magnesia	·92	,,
Potash	·60	,,
Soda	·40	,,
Carbonic acid	·04	,,
Phosphoric acid	·14	,,
Sulphuric acid	·06	,,
Organic matter and water of hydration	7·23	,,
Nitrogen	·185	,,
Including phosphoric acid, soluble in 1 per cent solution of citric acid (i.e. readily available phosphoric acid)	·004	,,

It is interesting to compare with the above the following analysis of soil, which is typical of a good deal of market-garden land in Middlesex, on a gravel subsoil, in which fruit of all kinds does well.

ANALYSIS

Soil dried at 212° F.

Loss on ignition	5·68	per cent.
Silicates	86·10	,,
Phosphoric acid	·06	,,
Oxides	6·54	,,
Lime (oxide)	·92	,,
Magnesia	·26	,,
Potash	·25	,,
Nitrogen	·28	,,
Equal to ammonia	·33	,,

But Nature does not seem to have opened all her heart to the agricultural chemist. Soil analyses must be taken in conjunction with the harvested results of observation and experience. They form a valuable indication to those with some practical knowledge; they are in no sense sure guides to the blind. By way of illustration, let the reader compare the analysis below with the one just given.

ANALYSIS

Soil dried at 212° F.

Loss on ignition	7·8 per cent.
Silicates	77·4 ,,
Lime (oxide of lime)	1·62 ,,
Potash	·26 ,,
Phosphoric acid...	trace only
Nitrogen	·526 per cent.
Equal to ammonia	·638 ,,

Now, to the lay mind at least, there appears very little difference in the proportions of the important constituents existing in these two soils of which we have the analyses.

Yet the former is what a farmer would call a light soil, liable to scorch in summer. The latter is of altogether a different physical nature—a farmer would call it good holding land and would choose it in preference.

The former will grow all kinds of fruit well, and bring them in a week earlier than the latter. The latter will not grow any of the better kinds of Pears, nor some varieties of Apples, while Plums, though growing vigorously on it, are specially subject to silver-leaf blight. It is possible to attempt to generalize too far, as will be seen when the different varieties of fruit come to be discussed, for the preferences of fruit for soil cover a pretty wide range of differences. (For the chemical composition of various fruit and vegetable crops see Vol. I. p. 109.)

Having settled the matter of soil, the next important question is that of site. Leaving considerations of market and carriage to be dealt with later, and confining ourselves to topographical conditions only, choose a site where there is a free current of air. Sheltered valleys where the air currents, finding no outlet, die down into calm repose, are no places for commercial fruit growing, for here it is that spring frosts, the "terror by night" of the fruit grower, are most frequent and most severe. It is unfortunate that it is so, because in such places the soil, either from the weathering of surrounding hills, or from alluvial deposits, will probably be the most productive that could be found. A tableland from 100 to 400 ft. above sea level is probably the best situation. Of slopes, those facing east and north are the least adapted, the best is south-west. The reason for this is that the damage by frost is greatly increased by the sun shining on the fruit and causing a rapid thaw.

Scientifically the explanation is that the frost crystals for their formation attract moisture from surrounding cells; when a rapid thaw takes place the released moisture hurrying back ruptures the walls of the cells. This, it is explained, is why, when it is a cloudy morning, or when it rains at sunrise, though there may have been a severe frost at night, little damage is done, and therefore fruit growing on the side of a hill that is in shadow until the sun has had time to warm the surrounding atmosphere is most likely to suffer the least damage. High situations will be exposed to winds. Against these the fruit trees can be protected by planting on the outskirts shelters consisting of beeches planted close and kept clipped at the sides so as to form a hedge, as is done round the bulb grounds in Holland; or firs may be planted if the soil is suitable. These latter should be planted in double rows and angled, thus forming a protecting belt.

Facility for getting the produce to a market will be a factor exercising considerable influence in determining the site. Where fruit only has to be considered it is sufficient to be within reach of a railway station; if on a good main line, so much the better, for fruit, being of greater value in proportion to bulk than vegetables, and not being so perishable, if properly gathered and sensibly packed, can be sent long distances. A glance at the baskets in any market in the north of England, Scotland, or Ireland will tell anyone able to read the marks on them that fruit is there from Kent, Middlesex, and Surrey. When vegetables come to be considered, the questions of market and transit thereto must be looked into thoroughly. (See Vol. IV.)

What is perhaps the most difficult and most anxious part of starting a garden yet remains to be dealt with, that is, settling the terms on which the land is to be held. These will include (*a*) the rent to be paid, (*b*) the conditions of the holding. If the freehold can be purchased, well and good; but inasmuch as to do so will involve the possession of twice as much capital as would be sufficient to start on a tenancy, it is taken for granted that the smaller number can manage it.

§ 3. RENT, RATES, AND TAXES

He who would hire land for market gardening or fruit growing must expect to pay more rent than is the rate for farm land in the same district. First, because he will require a smaller scope of land than a farmer, and land in small parcels seems always to command a higher rent per acre than when let in large blocks; and next, because of the greater liability which recent legislation in the tenants' interest has cast upon the landlord. The foregoing remarks do not apply to that large amount of land cultivated by market gardeners which is in close proximity to larger centres of population, and where the rent is governed by the commercial advantages it enjoys in nearness to market and cheap manure.

There is also the factor of competition among market gardeners and fruit growers, which has its effect in forcing up rents. The craze for growing Raspberries at Blairgowrie forced up the rents from £3 per acre to £12, and a similar process is going on in the Evesham district, and will be found to exist wherever market gardeners crowd together.

Doubtless there are many advantages in being closely associated with others engaged in the same industry, and in making that industry the dominant one in a district; but the advantages have to be paid for in increased rent. It may be that the question of a pound an acre is of small moment as between good land and bad land, but it cannot be denied that the increasing vogue of the growing of fruit and vegetables for market is decreasing the rate of profit, so that every item of expenditure must be carefully scanned, and this of rent cannot be called an unimportant one. Especially is this so when it is remembered that, under the existing method of levying taxation for local purposes, rates are based upon the rent. Legislation of recent years has taken the course of adding to the duties of local governing bodies, the expenses incurred in the discharge of such extra duties falling upon the occupiers' rate; thus the cultivator has found his liability to local rates a constantly increasing one, often in respect of services from which the town dweller reaps the benefit. Under the Public Health Act, 1875, the occupier of land is entitled to a reduction of three-fourths upon the general district rate. The Worthing Local Board made a determined attempt to deprive the cultivator under glass of the benefit of this provision in the famous Purser case. Happily the attempt ended in failure—the judgment in the Queen's Bench Court being entirely in favour of the market gardener—and the question has never been carried further. The same success has not attended the efforts of the market gardeners to secure the benefit to their greenhouses under the Agricultural Rates Act. By this Act land is allowed an exemption of half the Poor Rate, but it was decided in a case taken to the House of Lords that greenhouses are buildings and not entitled to benefit under it. Thus we have the curious state of things created by these two decisions: Under the first, market-garden land is still market-garden land though you cover it all over with glass; under the second, market-garden land ceases to be market-garden land, and becomes buildings, when you put up a greenhouse upon it. There is another matter in connection with local rating which will come as an unpleasant surprise to the starter in fruit growing. Our system of levying local taxation is admirably adapted for penalizing the active man and sparing the lazy one. When a man is guilty of a misdemeanour he is brought before the court, and society expresses its determination to put a stop to such conduct by the infliction of a fine. When a man invests his capital in the planting of fruit trees, society, in the persons of the overseers, expresses its appreciation of the enterprise, and in order to encourage others fines him heavily in the shape of an increased assessment, no matter what his rent may be, on the ground that he has added to the rental value. Some local authorities have tried to inflict this punishment upon the planter of Raspberries, but the courts could not go with them. The planter of fruit trees, however, may depend upon it he will not escape. Enough has perhaps been said to incite the intending fruit grower or market gardener to drive as hard a bargain as he can on the question of rent.

In the matter of income tax the market gardener, whether fruit grower or not, will find another case in which he is singled out from other agriculturists for specially unfavourable treatment. Under recent Finance Acts the maximum assessment for a farmer is fixed at one-third the annual value of the lands in his occupation; if, however, he makes less than this he can claim to be assessed under Schedule D and show accounts. He therefore enjoys an exceptionally favoured position. Not so the poor market gardener, whether fruit grower or not. He is assessed under Schedule D on the lines of Schedule B, that is, he is assessed upon an assumed profit per acre, and it is astonishing how high the ideas of the assessors are.

In order to save himself from being fleeced by these gentlemen, every market gardener must keep full and accurate accounts of his business. As between the market gardener and the farmer the provision is exceedingly unfair. If one-third the annual value of the lands in occupation is a fair average of the income derived by a farmer from the land he occupies, it is equally fair for the market gardener, whose rent will oftentimes be four or five times that of the farmer.

But the distinction between market gardener and farmer is becoming more and more difficult to maintain, for every year farmers are making more and more inroads into what were once market gardeners' crops, and by the competition induced on the markets shaving more and more valuable corners off the market gardeners' profit. No market gardener wishes to see any additional burden put on his brother agriculturist who farms, but he *does* think the time is past when he should be singled out for special milking by the tax gatherer.

§ 4. THE CONDITIONS OF THE HOLDING

It goes without saying that the best condition of all is to secure the freehold of the land; then all those influences resulting from a cultivator's energy, which go to improve the value of the holding, will work for his and not for another's benefit; but, as already remarked, it may be taken for granted that few will find it in their power to secure the freehold of sufficient land of the quality and in the position desirable for market gardening. The negotiations for a contract of tenancy must be conducted with great care, and it will be wise to secure professional advice. The market gardener will soon find, if he ever expected it, that he cannot obtain the conditions that please him best. He will be a lucky man if, when the agreement is signed, it is not a much more valuable instrument to the landowner for the protection of his real or supposed interests than for the tenant, who probably has had to pay all the cost of it.

Nothing can afford clearer evidence of the closeness of the land monopoly than the one-sided character of the agreements and leases for the letting of agricultural land which have come down to us from the past, breathing the spirit of overlordship and assuming the servility of feudal times. Reading through one of these leases produces a feeling of strangulation, as if one were being bound round by cord upon cord, from foot to head, until only fingers enough were left free to count rent. Such wildernesses of redundant verbiage, such forests of irrelevant details—one wonders who would ever have wasted the ink or the time to write it all, until we learn that the poor tenant had to pay all the cost, and the more skins of parchment the lawyer could cover with writing the greater the fee he was permitted to exact.

Happily the majority of English landlords have always been better than their own agreements, and the old-time farmer who signed his lease without reading it was depending on the sporting instincts of his landlord, who would know how to appreciate a good tenant, and was generally fairly dealt with. But the spirit of modern commercialism, for good or bad, has invaded the sacred precincts. The last vestiges of vassalage are dying out, and the market gardener who signs, with his eyes open, a contract of tenancy which does not secure him reasonable conditions under which to invest his capital, and exercise his skill, must not expect a kind providence, landlord or other, to deliver him from the consequences of his own folly. A curious state of things has been induced by the success which has attended the efforts of market gardeners to secure by legislation their right to the benefit of improvements effected by them in their holdings.

Previous to the passing of the Market Gardeners' Compensation Act, in 1895, many a market gardener found at the expiration of his tenancy the benefit of his most valuable improvements pocketed by his landlord. If he desired to renew the tenancy he must pay additional rent on his own improvements, or quit and allow the landlord to reap the harvest from another tenant; surely a divorce between legal claim and moral right as wide as can well be imagined, and a condition inconceivable in any other commercial relation except where land comes in!

By the Market Gardeners' Compensation Act, which came into force on 1 January, 1896, valuable provisions establishing the right of the tenant to the value of his own improvements first found their way to the statute book. So far as market gardens existing at the passing of the Act were concerned, it provided that where the cultivation of such holdings as market gardens was within the knowledge of the landlord, and he had not expressed dissent in writing previous to the execution of the improvements, then the provisions of the Act should apply as if it had been agreed in writing after the commencement of the Act that the holding should be let or treated as a market garden. This placed the cultivators of market gardens at the passing of the Act in an exceptionally strong position; because Section 3 (3) lifted the following improvements, so far as market gardens were concerned, out of Schedule I of the Agricultural Holdings

Act of 1883—where they required the written consent of the landlord to their execution before the tenant became entitled to compensation on quitting his holding in respect of them—to Schedule III, where neither the consent of the landlord nor notice to the landlord is necessary. The improvements referred to are:—

1. Planting of standard or other fruit trees permanently set out.
2. Planting of fruit bushes permanently set out.
3. Planting of Strawberry plants.
4. Planting of Asparagus and other vegetable crops.
5. Erection or enlargement of buildings for the purposes of the trade or business of a market gardener.

It is perfectly clear that the tenant of a holding which on 1 January, 1896, with the landlord's tacit consent, was being cultivated as a market garden, was free, without any hindrance on the part of his landlord, to make any of the improvements enumerated above, and to claim compensation for them. To any layman reading the clause it would also seem clear that in the case of a holding where any of the above improvements had already been executed previous to 1 January, 1896, and the landlord had not objected to them in writing previous to their execution, then at the expiration of the tenancy the Act entitled the tenant to compensation for them. For some time after the passing of the Act the clause was so understood, and compensations by virtue of it paid; but someone in Scotland took the view that the provision was not retrospective, and the question was fought, and taken from court to court, until ultimate wisdom in the House of Lords decided that the Act had no retrospective action, and applied only to improvements effected after its passing into law.

In 1908 an Act was passed consolidating the Agricultural Holdings Acts, and the Market Gardeners' Compensation Act was incorporated with it. This Act came into operation on 1 January, 1909, and remains to-day the statute upon the subject. The compensation clause of the Market Gardeners' Compensation Act appears in it with some verbal alterations. The first of such alterations seems designed to make it clear that the improvements for which a claim to compensation is established are those set out in the third schedule; the second is designed to meet the retrospective difficulty, and sets out that the compensation payable shall include improvements executed *before* as well as improvements executed *after* 1 January, 1896. It remains to be seen whether this has made the way strait and narrow enough to keep out the coach and four of the courts. The last alteration, whether so designed or not, seems to deprive the yearly tenant of any of the retrospective benefits of the Act.

A very important case is that of *Redwell v. Flint*, which has been decided in the Court of Appeal. This was a case which came up from the County Court of Canterbury. An umpire called in by two valuers, who could not agree upon a market-garden tenant's claim for compensation on quitting, declared himself unable to make his award until he had legal direction as to the bearing of section 61 of the Agricultural Holdings Act, 1883, upon section 42 (2) of the Agricultural Holdings Act of 1908. This latter Act was supposed to have consolidated the law upon the subject! The County Court judge decided to direct against the market gardener, and his decision was upheld by the Court of Appeal; so once again the coach and four of the courts was driven through the Act, and a large number of market-garden tenants cultivating under yearly tenancies are deprived of the power to obtain compensation for capital and labour expended on improving their holdings, which they thought the law had once for all secured to them.

The matter was brought to the notice of the Central and Associated Chambers of Agriculture on the report of their Market Garden and Fruit Growing Committee. The gravity of the position was immediately perceived. Members of Parliament present, without respect to party, offered their assistance, with the result that Mr. Eyres-Monsell, the member of Parliament for Evesham, on 8 December, brought in a one-clause Bill, designed to repair the breach which had been made in the law. The autumn session of 1911 was, however, too near its close, and there was not time to pass the measure into law. However, it is hoped the Bill will be passed in the immediate future.

Section 42 of the Act makes it indisputable that when once it is agreed in writing that any holding shall be cultivated and treated as a market garden the provisions of the Act as to freedom to execute improvements, and as to claim to compensation for them, shall apply, and the tenant will therefore be secure. Even if by a subsequent clause in the agreement the tenant agrees to forgo his right to compensation, his claim will stand, and the landlord cannot enforce it, for Clause 5 provides: "Subject to the foregoing provisions of this Act, any contract (whether under seal or not) made by a tenant of a holding, by virtue of which he is deprived of his right to claim compensation under this Act in respect of any improvement comprised in the First Schedule hereto shall be void so far as it deprives him of that right". It is significant of the conditions affecting land tenure that such a clause should find its way into an Act of Parliament.

The difficulty referred to above comes in here, that many landowners and their advisers are averse to agreeing that their land should be used for the purposes of market gardening, which it has been seen can include fruit growing at the option of the tenant. If a tenant who desires to use the land as a market garden and to plant fruit on it agrees to a contract of tenancy in which it is not precisely stipulated that he may do so, then of course he forfeits his right to compensation at the end of his tenancy for anything except the ordinary agricultural items, which, as mostly inapplicable, will in his case amount to very little. If he cannot find a landowner who desires to be the landlord of a market gardener, what is he to do? Now it must be admitted that there is something to be said for the landowners' point of view, which has been quickened by some claims to compensation settled by arbitration soon after the passing of the 1896 Act, in which the decisions unduly favoured the tenants' claim.

A landlord ought not to be compelled, nor asked, to pay more for a tenant's improvements than a sum which will represent a capitalization of the annual rental value they have added to the holding, based upon a calculation of the probable duration of that added value if the holding were let again as a market garden. To this a tenant is morally and legally entitled, and to nothing more.

The mischief is that to assess such value requires a practical knowledge of market gardening, which few valuers possess, and hence you have had the edifying spectacle of a valuer who knows little about many of the things he is "valuing", on one side, asking a ridiculously exorbitant price, and on the other side another valuer, knowing quite as much as his "friend", offering an absurdly low one, and the whole thing being referred to a legal umpire more destitute of practical knowledge than either of them.

What wonder that some wicked people have hinted that the two valuations have been added together and the mean taken, after sufficient costs have been run up!

What wonder, too, that there have been decisions with but a distant relationship to the actual value of the things claimed for!

Happily the 1908 Act simplifies the procedure on arbitration, which, it may be hoped, will reduce the costs, and provides for the appointment of an Arbitrator by the Board of Agriculture, on the application of *either* party. It may be hoped that the Board will get some valuers conversant with market gardening on their list.

It is evident that the prospective market gardener must be prepared to enter into some arrangement which, while protecting his own interests, will get over the aversion of the landowner to the liability of a market-garden tenancy. A considerable part of the landowner's objection has been the uncertainty of the amount of the liability incurred. A liability of which the maximum amount and the time of maturing is known can be provided against, and some have found a way out of the deadlock by agreeing that the amount of compensation shall not exceed an average of a certain sum per acre. Provided the sum agreed upon is a reasonable one, such agreement for compensation would come within the provisions of Clause 4 of the Act of 1908, and be perfectly regular.

In Worcestershire what is called the "Evesham Custom" is largely made use of, and has provided a satisfactory basis of many tenancies. By this the outgoing tenant agrees to find a satisfactory incoming tenant who will pay him his valuation. It is manifest that such an arrangement will only work where it is the desire of the landlord to continue the holding under market gardening; it will not be applicable to those many holdings, near London especially, where at the conclusion of the tenancy the land is to be handed over to the operations of the builder. In such cases the rent appears to be the only area within which an arrangement can be come to, if a limitation of the amount of compensation to be claimed per acre as suggested above is not accepted as a settlement.

Landowners themselves are also endeavouring to find a way out of the difficulty. One such, who desires to encourage fruit growers on his estate, has devised a form of agreement which he says has cost him and his advisers much time and thought, and which he thinks may prove a model fruit-growing agreement. It is in the nature of a hiring of the fruit trees and bushes from the landlord, who supplies them as he does the land. Among its provisions are the following:—

1. Reservation to the landlord (except for provisions of Ground Game Act, 1880) of all foxes, game, hares, rabbits, woodcock, snipes, rails, quails. All rights of hunting, shooting, fowling, hawking, coursing, and fishing, with full and free liberty for the landlord, his friends, gamekeepers, and servants, and every other person authorized by him, to search for, hunt, shoot, course, fowl, hawk, sport, fish, and preserve over and upon the said land.

2. That the tenant will not (except as mentioned below) plant any fruit trees or bushes, except such as shall be provided by the landlord.

3. And it is hereby agreed and declared that when the premises or such part of them as is to be planted have been well cleansed and prepared to the satisfaction of the landlord, the landlord will (subject as hereinafter mentioned) at the request of the tenant provide upon the premises all Apple, Pear, and Plum trees, also Currant, Raspberry, and Gooseberry bushes of the varieties selected by the tenant. The landlord shall be at liberty to object to any variety. And it is hereby mutually agreed that no more than so many varieties of any one kind of fruit trees should be planted.

4. All trees and bushes planted during the tenancy shall be and remain the property of the landlord, and the tenant shall not claim or be entitled to any valuation or tenant right in respect of them nor for the superintendence in planting thereof. The trees and bushes so to be supplied by the landlord shall be maidens, and the tenant shall not permit any fruit to be borne by the trees during the first two seasons after planting or by the bushes during the first season after planting.

5. The landlord will replace any Apple, Pear, or Plum trees, and any Raspberry, Gooseberry, or Currant bushes, that may die within two years of the date of planting. If and whenever any tree or bush shall die after the expiration of two years from the date of planting it shall be replaced by the tenant, who shall maintain the same number and variety of trees and bushes as supplied by the landlord, unless by the growth of the trees it shall be found that any variety is unsuitable to the soil, it shall be replaced by the tenant by another variety approved by the landlord.

6. All fruit plantations of trees or bushes shall be guarded from hares and rabbits with wire netting, 4 ft. wide and 1½-in. mesh, laid with 6 in. turned in under the soil. Landlord to supply posts, and tenant to provide wire netting, and lay same without any compensation.

7. Schedule of hiring for fruit trees and bushes.

Annual Rent payable on	Per 100 or Portion of 100 Trees.			Per 1000 Bushes or Portion of 1000 or 5000 Raspberries.		
	£	s.	d.	£	s.	d.
1st year	Nil			Nil.		
2nd ,,	Nil			Nil.		
3rd ,,	Nil			1	0	0
4th ,,	Nil			2	0	0
5th ,,	0	3	4	3	0	0
6th ,,	0	10	0	and subsequent years.		
7th ,,	0	15	0			
8th ,,	1	0	0			
9th ,,	1	10	0			
10th and subsequent years	2	0	0			

As this particular agreement very nearly captivated one beginner on the lookout for a holding, and might prove seductive to others, it may be worth while staying to see how its provisions will work out. If the land were fully planted with half-standard trees and bushes, as is the custom generally in Kent, the landlord would have to provide, roughly—

	£	s.	d.
160 maiden trees per acre at 40*s.* per 100 ...	3	4	0
1000 ,, bushes ,, 80*s.* per 1000 ...	4	0	0
Total expenditure of landlord per acre ...	7	4	0

In the case of the bushes he is two years without interest. Allowing 5 per cent at compound interest his £4 will have grown to £4, 8*s.* 2½*d.*, for which he receives on the third year £1 or 20 per cent, which is doubled on the fourth year, increased by 50 per cent the fifth year, and thereafter remains at the modest figure of something over 65 per cent per annum.

On the fruit trees he gets no return for four years, by which time his £3, 4*s.* has increased to £3, 15*s.* 1*d.* In the fifth year he gets 3*s.* 4*d.*, nearly 5 per cent, but on the sixth year he gets 10*s.*, and by the tenth year, when high-water mark is reached, he is receiving 40 per cent per annum, and at this figure the charge remains till the termination of the tenancy or the end of the tenant's resources, whichever comes first. The only deductions from these returns the landlord has to suffer is the cost of replacing trees or bushes that die during the first two years. Now, how does the tenant fare? He has to pay the rent of the land from the commencement of the tenancy, which in the case under consideration was to be £2, 10*s.* per acre. On this also he pays rates. He has to clean and prepare the land, to plant it, to provide and fix the wire netting, to keep the land clean, to prune and tend the trees, and if any trees or bushes die after the second year to replace them and still pay hire to the landlord for them. His expenditure will amount to £20 for the first year, and by the third year it will have grown to £35 per acre, from which he has not received one penny of return, unless indeed he has managed to take a catch crop from among the trees and bushes, which would take a little of the charge for rent of land and rates off the account of the fruit plantation. Thus at the third year the position is:—

Tenant's Investment on Fruit Plantation.	Tenant's Return.
£35 per acre.	Nil.
Landlord's Investment on Fruit Plantation.	Landlord's Return.
£7, 18*s.* 9½*d.* per acre.	£1.

How does the tenant stand at the tenth and subsequent years, when all the fruit rents have grown to their full stature?

	£	*s.*	*d.*	
Rent of land	2	10	0	per acre.
„ 160 fruit trees	3	4	0	„
„ 1000 bushes	3	0	0	„
Total annual rent... ...	8	14	0	„

This, plus the preservation of foxes, hares, rabbits, &c., makes as good an example of the "heads I win and tails you lose" sort of arrangement as could well be imagined.

The cost of the trees and bushes forms so small a part of the expense of making a fruit plantation that it would not be generous of the landlord to give them, if he expects the tenant in return to waive his right of compensation in respect of them. [W. G. L.]

§5. PREPARATION OF THE LAND FOR FRUIT TREES

Having selected the site and concluded a contract of tenancy for the holding, the next consideration is the preparation of the land for planting the fruit. The first thing is to get the land clean. He will be a lucky man who takes land that has been farmed if he does not come into an inheritance of original sin in the shape of perennial weeds such as couch grass, thistles, nettles, bindweed, or coltsfoot. These must be got rid of. To plant fruit trees and bushes among them would be to mortgage the enterprise at the start; once get them among the roots of the trees and bushes, and they will cling like a bad habit. If possession is entered into at Michaelmas there will be time to ridge baulk the land. This is done by drawing shallow single furrows about 10 in. apart, so that the soil off the plough breast falls on the space between the furrows, and then turning the whole of the soil to the depth of the first furrows over into the spaces where the first furrows were turned from, so that the soil lies in a ridge. The drags can then be put through it crosswise of the ridges, and all weeds and rubbish will be found on the top. After harrowing and rolling once or twice, to break lumps and shake the dirt out, it may be forked into rows and burnt. If the land is very dirty the process may have to be repeated. For these processes drag harrows (fig. 318) which can be obtained for from two up to four horses; cultivators (fig. 319) which can also be obtained for two, three, or four horses; harrows (fig. 320), for one or two horses, and a Cambridge roll (fig. 321), and a plough which will turn the land over in rectangular furrows are required. What are called digging ploughs are not so suitable for such work, as they flop the soil over in a confused medley, and it does not so readily catch the tines of the drag or cultivator, unless the land be very light—then almost any plough will do.

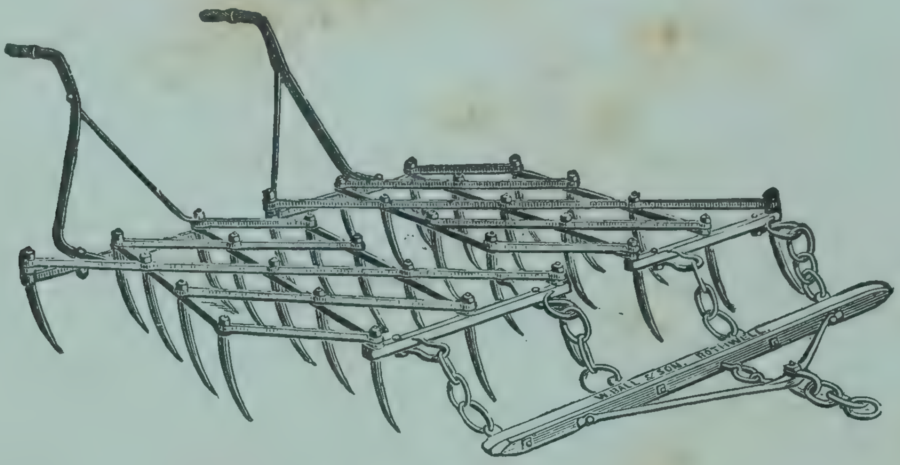


Fig. 318.—Drag Harrow

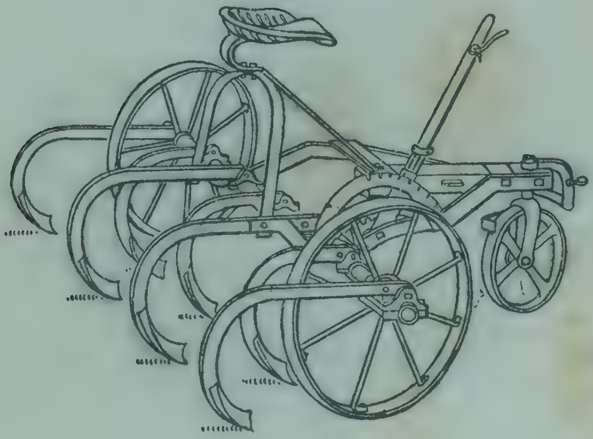


Fig. 319.—Cultivator

When the surface cleaning is thoroughly done the land should be baulked up again and so left through the winter. In the spring the baulks may be harrowed down; if the holding is near enough to a market to grow vegetables the land may be manured with dung, 40 loads to the acre; or with crushed hoofs, 5 cwt. to the acre; and fine-crushed bones or dissolved bones, 3 cwt. to the acre, and ploughed in. Part of it can be planted in May with Brussels Sprouts,

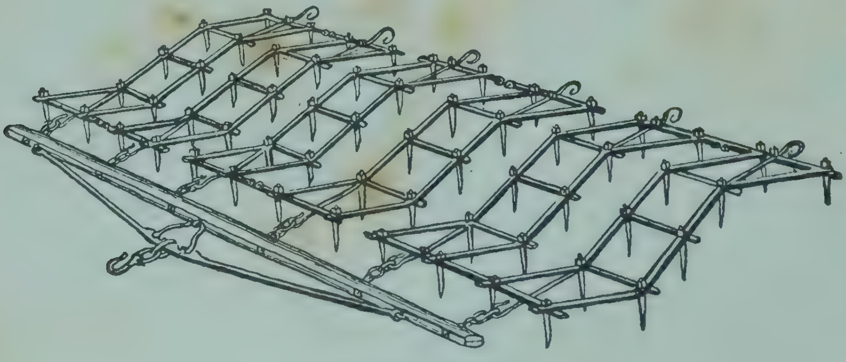


Fig. 320.—Harrow

previously raised on a seed bed from a sowing made in March. They should be planted 3 ft. by 2 ft. 6 in. on the square, so that the horse hoe can be worked both ways. Another portion can be planted in June with Savoys, also previously raised in a seed bed from a sowing made in April. These should be planted 2 ft. 6 in. by 2 ft. and planted on the square. A remaining portion can be planted also in June with Coleworts, planted 18 in. by 18 in. on the square, the seed to be sown at the same time as the Savoys.

These green-stuff crops, if the horse hoe and the man hoe be kept well at work among them during the summer, will smother any weeds that may have remained from the autumn cleaning, excepting such deep rooters as thistles, bindweed, or coltsfoot, and even these will be much weakened.

The Coleworts and Savoys will be off in November, and the Brussels by Christmas, thus leaving plenty of time to plant the trees, which a careful man will buy in the summer, and have heeled-in in the autumn. Of course if the holding is one on which horses are not used, then all the cleaning must be done by forking and picking.

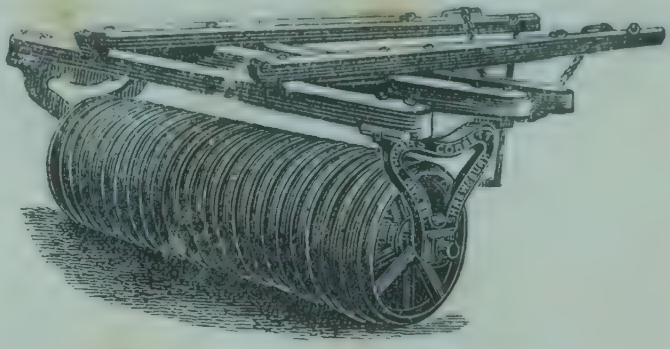


Fig. 321.—Clod Crusher (Cambridge Roll)

Now comes the question, how shall the land be prepared for the fruit? Here rival schools assert their differing theories. Shall it be deep cultivation or shallow? Shall it be by plough or spade, and if the latter shall it be digging, double digging, or trenching? He who proposes to grow fruit for a living, and cannot draw upon unlimited supplies of money, must discard elaborate theories beloved of experts who do not spend their own money. Doubtless double digging or two-spit trenching does make a splendid deep tilth for the trees and bushes to go into, but either will cost anything from £12 to £16 an acre, according to the nature of the soil and subsoil to be dealt with, and the trees and bushes may not show appreciation of the extra expense. The object of cultivation is to move the soil thoroughly, bringing fresh particles up to the action of wind and weather; to keep it open and pervious for water to reach the roots and rootlets; and so that the micro-organisms that constitute fertility may secure oxygen and be free to multiply.

If the soil is never moved except to the depth of a few inches, the bottom becomes hard and impervious, like a pan, and the fertility becomes, like beauty, only skin deep. It stands to reason that, except for such crops as prefer a hard bottom, the deeper the soil is moved and the more thoroughly its particles are broken up, the more the forces we call fertility are increased and the freer they are to work; and in times of drought the more moisture will be held by the finely separated particles for the use of the crop. Mr. A. D. Hall says (*The Soil*, p. 100): "The soils which are least affected by drought are the deep loamy sands of very uniform texture, fine grained enough to possess a considerable lifting surface, and yet not too fine to interfere with the free movement of water". A fruit tree when once established in suitable soil is able to send its roots into the subsoil and do its own pulverization; it is only during the first year or two after planting, when it has not had time to develop its root system, that it needs the soil finely prepared for it. It is generally considered to be sufficient, therefore, for all practical purposes if the soil is broken up to the depth of 18 in., and this will also do for bush fruits. The question of deep and shallow cultivation has been dealt with in Vol. I., pp. 101–25.

In spade culture the cheapest way to accomplish this is by bastard trenching, which is turning one spit over, shovelling the bottom of the trench, and then forking the bottom. This will cost from £6 to £8 per acre according to soil. In mechanical culture the best way will be to get the land steam-scarified twice, the second time at right angles to the first. This will cost 14*s*. per acre exclusive of coal and water, and the cartage of them to the engines. The land can then be ploughed with horses, care being taken not to have the furrows wider than 8 in., so that all the surface soil is thoroughly moved. The ploughing and subsequent harrowing and rolling for planting will cost about 20*s*. per acre.

Planting can be continued all the winter, during suitable weather, up till March.

Analysis of the soil will give some idea of what manure is desirable. If a deficiency of lime is shown, it will be convenient to apply a dressing of fresh burnt lime of 4 tons to the acre, and let it slack before the land is scarified. It is generally not wise to plough a dressing of dung in when planting fruit trees; it is better applied as a "poultice" or mulch round each tree and bush after planting. By such a plan the nourishment in the dressing is washed by the rains down to the rootlets, and by checking evaporation it is a valuable help to the young plantation during dry spells in the summer.

On soils suitable for the cultivation of fruit little of nitrogenous manures is required; lime, phosphoric acid, and potash will be found the most effective. The lime can be applied in a dressing of 3 or 4 tons to the acre in the winter about every four years. For the others a dressing of 4 cwt. of a good brand of basic slag and 1 cwt. of sulphate of potash in the early autumn will be found a convenient method.

In many successfully cultivated fruit gardens a mulching of long dung is put on once every three or four years in the late winter or early spring. This plan may be strongly recommended when a fully cropped garden has reached maturity, and the soil at the surface consequently becomes crowded with root fibres.

But it cannot be too frequently reiterated that one of the most important things is to keep down the wild growths that, if allowed to grow, will rob the trees and bushes of nutriment and moisture. Weeds are the labourer's friend, but the grower's enemy. Hoe as soon as the weeds appear; it is cheaper to hoe three times when hardly any weeds can be seen than to wait till there is a tangled and matted carpet of growths which have sucked enough from your soil to produce flowers and develop their seeds. The more mouths there are to feed from the cupboard the quicker its shelves become bare. (See Vol. I., p. 121.)

While the operations for cleaning and preparing the land are going on the grower will find employment during the evenings of his first winter of occupation in studying nurserymen's catalogues and in gathering all the information he can as to how to set out his plantation, what distances to plant, and whether to intercrop with bushes, or with other crops, or not at all.

He will have little difficulty in deciding that while he will plant in straight rows each way, he will have the widest spaces running north and south, if the conformation of his land makes it at all possible.

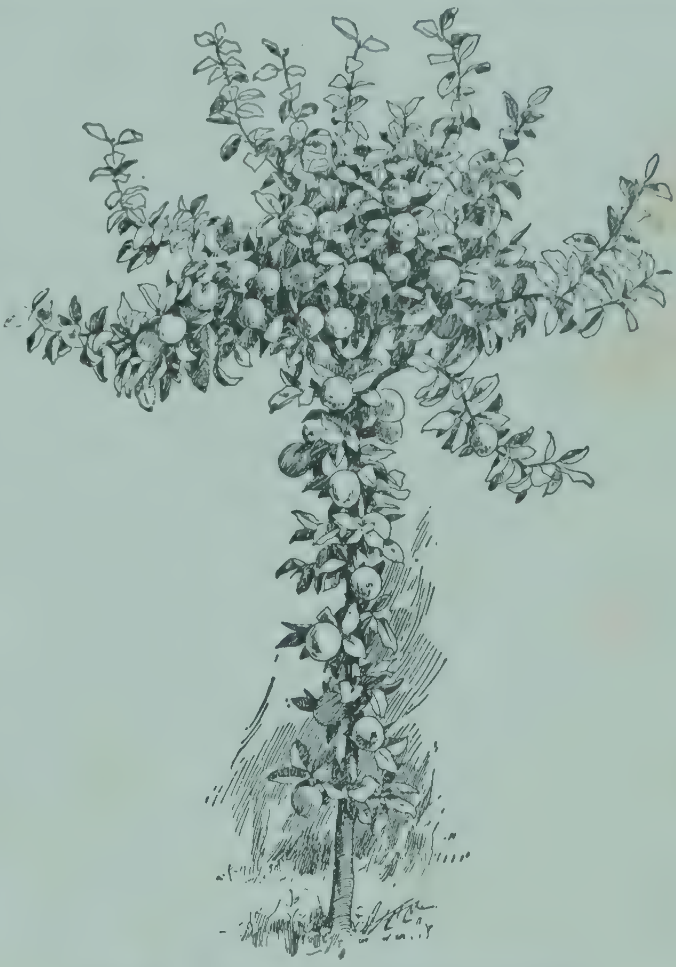


Fig. 322.—A Young Standard Apple Tree in Fruit

He will take care not to have his rows too long without a break. As he hopes to get fruit he will reflect that such fruit must be carried out. If the distances are too long, too much of his own or his gatherers' time will be taken up in walking to and fro. He will therefore arrange for a roadway whenever his rows approach to 300 yd. in length. It may be that around the outskirts of the land he proposes to plant there is that feature that gives peculiar beauty to an English landscape, and that in the breast of the grower, frequently, causes a conflict between his æsthetic tastes and his instincts as a cultivator—hedgerow timber. If there is, it goes without saying that there is a clause in his agreement binding him to respect it as landlord's property. He will certainly try and arrange to use the space immediately under it as a roadway, and will select to plant near it some varieties retaining from their ancestors qualities that enable them to accommodate themselves more or less to the conditions of hedgerow existence, such as the Damson and the Bush Plum.

He will have before him several methods of planting to choose from.

1. The method of planting rows of half-standard trees, 40 or more feet apart, and cropping between with vegetable crops. This may be seen in operation at Evesham. (See p. 28.)

2. Half-standard trees, 15 ft. apart, with bushes between the trees and one row up the middle. If the bushes are Red Currants, there may be two rows up the middle. Raspberries may be planted instead of bushes, or one row of cordon Apples may be planted between the rows, and bushes in the rows.

3. Standard Apples (fig. 322), 30 or 36 ft. apart, and half-standard Plums between the rows and between the trees in the rows, or Nuts may be planted under, as is done frequently in Kent. Cherries may take the place of the Apples.

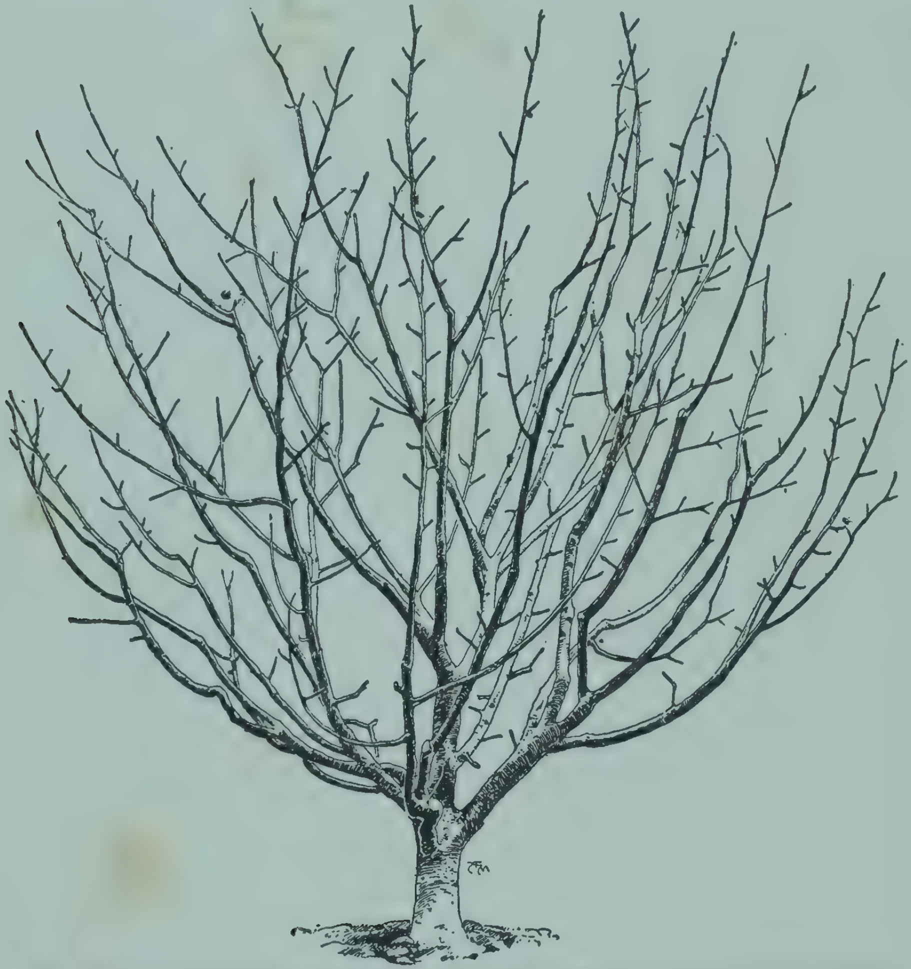


Fig. 323.—A Well-developed Six-year-old Dwarf or Bush Apple Tree, after pruning

4. Dwarf Apples and Dwarf Pears (fig. 323) may be planted 9 ft. apart, with Strawberries planted three rows at 2 ft. 6 in. apart between the rows, and four plants between the trees, or the trees may be 12 ft. apart, with a Currant or Gooseberry bush angled between them, thus:—

Apple. Apple. Pear.
Gooseberry Gooseberry.
Apple. Apple. Pear.

Of these methods it is difficult to see the advantage of No. 1. It seems to be neither open land nor fruit plantation. Doubtless it gives the trees plenty of air, and they in turn may shelter the vegetable crop. With No. 2 the half-standards are frequently Apple and Plum, or Pear and Plum interlined.

In the case of the Apple and Plum it is generally the intention of the planter to cut the Plums back as the Apples grow, and finally remove them altogether, and leave it all to the Apples. It may be doubted whether the intention is often carried out; it requires more courage than the average grower possesses. The Plums are useful revenue producers, even when they crowd the Apples. It is better to admit the difficulty beforehand, and plant the half-standards 18 ft. by 15 ft., and let them both remain, choosing the varieties of Apple of not too spreading growth. If this is done, two rows of Gooseberries, or Raspberries, or Black Currants, and three rows of Red Currants, can be planted between the rows of trees. Strawberries may be also planted under, one row between each two rows of bushes. If a jam factory is within reach it will be better to plant the preserving sorts, like "Stirling Castle" or "Scarlet", as these can be left down longer than a table sort, although of a sort like "Royal Sovereign" two or three crops may be taken before they are hoed up, to give the bushes and trees all the room. If the rows are 18 ft. apart, as suggested, a row of Dwarf Apples or Pears may be planted instead of the bushes or cordons. It would be wise in any case, if the situation were convenient for its disposal, to grow green-stuff crops between the tree rows for a year or two before planting the bushes. It will give a better opportunity of eradicating any weed progeny remaining in the soil, and will also afford a chance, if it is needed, of bringing the condition as to manure up to par.

The bushes that are to go into the middle may meanwhile be accommodated as extra ones in the tree rows. When it is determined to plant between the rows they may be shifted in the early autumn, care being taken to preserve unbroken a good ball of earth at the roots, and they will not "miss the shift", as the gardeners' saying goes. In No. 3 the intention is eventually to have an Apple orchard when all the Plums will be removed. At the beginning the conditions as to undercropping may be the same as in No. 2.

But it cannot be said that the plan of planting standard trees is in accordance with the most up-to-date ideas.

If spraying is to become a permanent part of a fruit-grower's organization it will be wiser to keep the trees as low as possible. No. 4 method will therefore have much to recommend it on this ground alone. The consideration of it will lead to the study of the different stocks on which Apples are budded or grafted. These are: (*a*) The Crab; (*b*) The Free Stock; (*c*) The Broad-leaved Paradise; (*d*) The Doucin or Dutch.

(*a*) *The Crab.*—This is nothing more than the Wild Apple, the parent from which, through careful selection and patient observation and application of the beneficent laws of the Creator, all our many varieties of Apple have come. The characteristics of Apples worked on this stock (fig. 324), allowing for the divergences of individual characteristics, are strong, thick roots delving deep in the soil, producing vigorous, often luxurious, growth. The commencing of fruit-bearing is sometimes deferred until the tree has attained a considerable age; in the case of the "Duchess Favourite" it may be twenty years, and in the case of the "Blenheim Orange" more. The Crab is the only stock for half-standards and orchard standards.

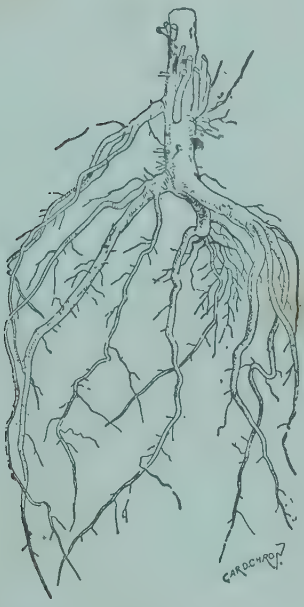


Fig. 324.—Wild Crab Apple Stock

(*b*) *The Free Stock.*—This is often erroneously bracketed with the Crab, as being synonymous with it; but frequently it is obtained by sowing the pips from apples used in cider-making, and may possess the characteristics of widely differing parents. These may suit the variety worked on them, or they may not.

(*c*) *The Paradise.*—The first trees on this stock (fig. 325) were imported from France, but the French Paradise stock has proved too shortlived, and the planting of Apples worked on it may have led to some wholesale condemnations of the stock generally which are certainly not justified. There is an English variety which is sturdy and longlived. The advantages of Apple trees worked on the Paradise stock are: No tap roots, but roots of a fibrous nature that remain near the surface, and admit of more control by the cultivator; short, jointed growth that allows of closer planting; and, finally, quicker development of bearing capacity, often five years earlier than the same variety on the Crab.

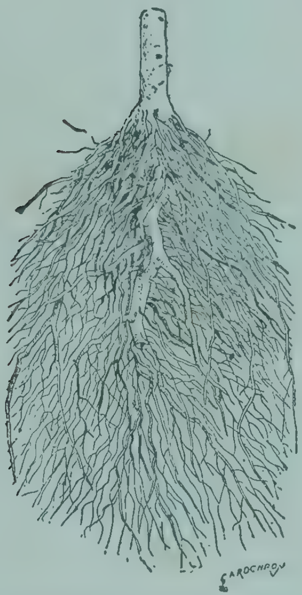


Fig. 325.—Paradise Stock

(*d*) *The Doucin* or *Dutch* possesses similar characteristics to the Paradise, only with more vigour of growth. This is an advantage with some varieties, as, for instance, "Early Victoria" and "Stirling Castle", which will crop so furiously on the Paradise as to leave no spare energy to grow a tree. It is important to remember that when planting trees on the Paradise or the Doucin stock, the place where the scion was put on to the stock should be below the level of the soil, and it should not be forgotten that the soil, after the planting, will settle considerably.

It will be apparent at once that if Dwarf Apples only are planted, the fruit will be more easily gathered, and it will be there to gather sooner. Insect and fungoid pests, also, will be more easily detected and dealt with. The initial outlay will be greater, because the trees cost more, and it will take more of them to the acre.

An additional method, with much to recommend it, is to plant the Plums by themselves, 15 ft. apart, and bushes under, with Strawberries between, and the Apples and Pears in separate sections, Dwarfs with cordons up the middle and Strawberries under. It must be borne in mind that when planting a block of one kind of fruit tree it is not wise to plant all of one variety together. More fruit and a better quality will be produced if the advantages of cross fertilization are secured by planting no two adjoining rows of the same variety.

The best age for planting half-standards and dwarfs is two years, for bushes two or three years. Raspberries are, of course, always canes of one summer's growth.

The cost of making a plantation will depend upon (*a*) the expense of preparation, approximate figures of which have already been given; (*b*) the cost of the trees, which will vary according to variety from 50*s.* to 70*s.* per 100 for half-standards, about 150*s.* per 100 for standards, 60*s.* to 85*s.* per 100 for dwarfs, 80*s.* to 100*s.* per 1000 for bushes, and 20*s.* per 1000 for Raspberries; (*c*) planting, which will cost 1*s.* 6*d.* to 2*s.* per dozen for the trees, 3*s.* per 100 for the bushes, and 10*d.* per 1000 for the Strawberries. Before planting, all broken roots should be cut with a clean sloping cut, and care should be taken that the soil is shaken well in among the rootlets, which should be trained carefully out from the stock as centre. To make a hole, stick the tree up in the middle, flop shovelfuls of earth lumpy and unbroken on, and then jump on it, is not the way to plant a fruit tree.

Whether to prune back the top before planting or not is a question on which opinion is divided. Each plan has able advocates, and each side can point to flourishing plantations as proof of success. There seems much force, however, in the argument of one side to the controversy, that when you have harassed a tree by uprooting him he does not want at the same time the additional handicap of amputations at the other end, and it will be found to answer well to leave top pruning until the first winter after planting, when the shoots can be cut hard back, always to an outside bud, with the assurance that they will throw out good strong frame-making growths in the ensuing summer. (See figs. 326 and 327.)

When pruning a young tree, it must not be forgotten that the shoots now so slender will one day be main branches, and will want room to develop. It will therefore not be wise to leave them as thick as the stakes of a basket. If there are a few short thorny growths on the stem, don't cut them off the first year; by leaving them they will assist the development of the bark. Half-standard trees, as a rule, do not want staking, but better stake than allow them to be bent or broken by winds.

If you stake, tie some sacking or strawband round the tree stem to prevent it rubbing against the stake, bearing in mind that the most virulent of the pests that bother a fruit grower find an entrance through wounds in the bark, and have no other means of entrance. As the stem will increase in diameter as the tree grows, it will be necessary to attend to all bands tied round the trees every winter.

Rabbits and hares are a great nuisance, causing much damage to Apple and Pear trees. They do not seem to attack Plums or Cherries so much. By biting the bark as high as they can reach, in frosty weather, when other food is scarce, they are especially mischievous, and may cause the loss of many trees.

The best method of protection is to put round the tree a little ring of wire netting of 1-in. mesh, 2 ft. high where there are no hares, 2 ft. 6 in. where there are. It should be cut generous enough to allow for the growth of the tree stem, and should be secured to a short stake driven into the ground.

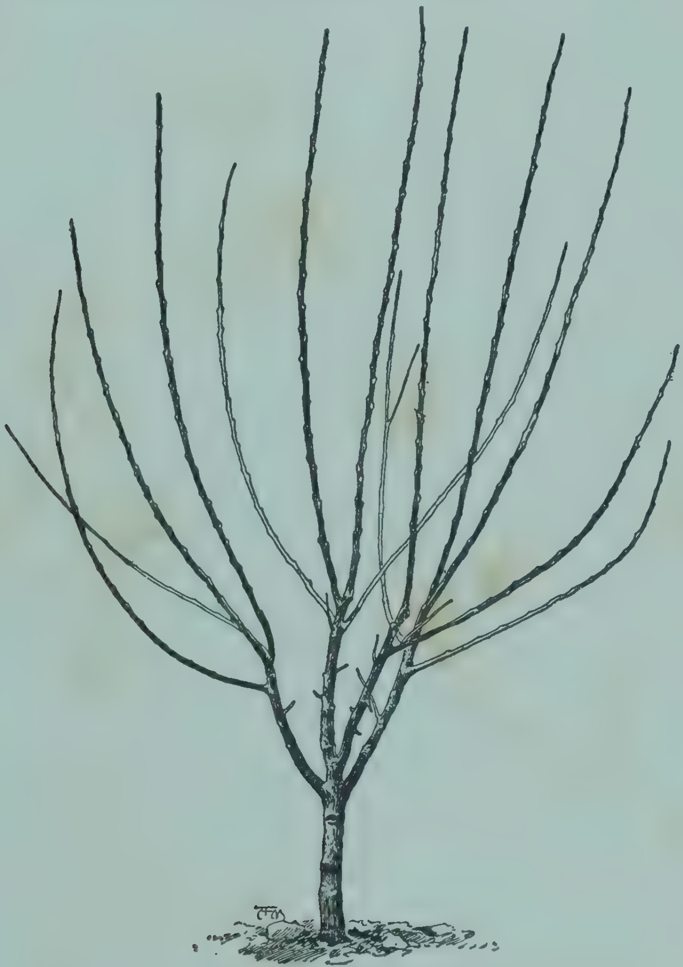


Fig. 326.—Three-year-old Dwarf or Half-standard Apple, before pruning

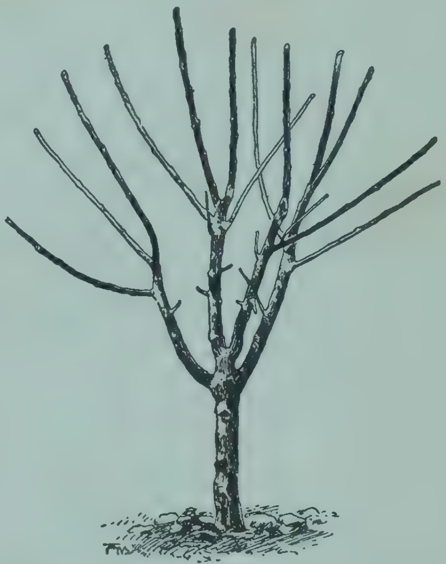


Fig. 327.—The same tree, after pruning either for a pyramid or a bush

To get the trees, go to a nurseryman with a reputation to maintain; don't look after bargains. Cheap trees are like cheap labour, blessing neither him that takes nor him that gives.

The maintenance of a plantation until it comes into bearing is the most expensive part of the business, and most often imposes the greatest strain upon the resources of the beginner. Yet everything in the after results of the enterprise depends upon the doing of what should be done during this period thoroughly and at the right time. The man who commenced to build a tower without counting the cost thereof was a statesman compared with the man who goes to the trouble and expense of planting a fruit garden without making sure that his resources are sufficient to bridge the space between planting and bearing. This may be helped, as has been hinted already, by intercropping during the first year or two. Any ordinary vegetable crop will do, especially such crops as Brussels Sprouts, Savoys, Coleworts, as they allow of the land being partly fallowed in the spring, and, when they do well, are strong enough to choke weeds. Where vegetables are not grown, Mangolds, Cabbage, Turnips, or Swedes will do. If it is proposed to fold sheep, the hurdles must be set to protect the trees, or the sheep will do similar mischief to that done by the hares and rabbits, only more so.

Corn will not do, nor Peas either, because they will only increase the stock of weeds to get rid of. In intercropping, the trees and bushes between them should have breathing space. It is unwise to choke trees and bushes with the crops between, as is sometimes done. If this system is followed for the first three years, and the bushes for the middle row, or rows, grown on between the trees as suggested previously, the fruit plantation may be charged a third of the rent and rates and a third of the cost of manures.

The hoeing of the trees and bushes would cost 20*s.* an acre each year. The pruning, which would be done for 5*s.* to 6*s.* an acre the first year, will increase in cost to 20*s.* by the fourth year. There may be spraying to do, which will cost anything from 10*s.* to 20*s.* an acre, according to the material used and the number of times it has to be done. By the fifth year Plums, Dwarf Apples, Pyramid Pears, and the bushes will begin to yield an appreciable return. The bushes that are moved out of the tree rows into the middle on the fourth year will not bear so much as the others for the first year, and the Strawberries planted between the bushes will yield no revenue the first year, but it may be hoped that the crop on the trees and bushes that remain will make up for the loss of the vegetable or other crops for that year. Altogether it may be reckoned that by the time the fifth year is reached the expenses of maintenance have exceeded the returns by an aggregate of £20 an acre, and this in addition to the expenses of planting.

There will be a natural desire at this stage, especially in one contemplating entering the business, to know what returns this expenditure may be expected to produce. This is a part of market gardening that commercial men are often unable to understand; there are so many forces at work which influence the result, the effect of which it is impossible to foresee, that any estimate not based upon the average of a wide range of years is likely to be completely misleading. In 1907 there was a phenomenally heavy crop of fruit all over England; since then the fruit crop has been a comparative failure. A plantation of Victoria Plums that produced 5000 half-sieves in 1907 produced 14 in 1908! It may be taken for granted that most of the estimates of the probable returns to be obtained from fruit, that one sees, were written when the writer was in an exceedingly optimistic frame of mind. In the paper read by Mr. C. D. Wise, which has already been quoted from, he says: "From a field planted with half-standard or standard trees, Black Currants and

Strawberries, the net return should be £20 per acre, and the average annual return for mixed plantations may be taken at that amount, though in some seasons it would be far more." Unfortunately, Mr. Wise has not told us what he means by "net". Does he mean that after all the expenses incident to producing, marketing, and with share of establishment expenses deducted, the cultivator of an acre of fruit such as he describes will have £20 to spend upon his household and himself? This is the natural interpretation of the words. That is, the cultivator of 20 ac. of fruit in bearing can count upon an average net income of £400 a year! That he may do it on some years is conceivable, indeed he must, and more, or his average would be small indeed; but the average is nothing like this. Let the reader before he invests his capital upon such expectation enquire into the circumstances and examine the mode of living of some typical fruit growers and then form his own opinion. It is manifest that if such returns were obtainable, the men who are cultivating 300 ac. of fruit—and there are many of them—would be enjoying princely incomes, and of this there is no evidence. If an average return of £10 per acre is obtained after paying all charges and outgoings, the cultivator should consider himself an extremely fortunate man; nothing like this will certainly be obtained till after the tenth year. [W. G. L.]

SECTION XVI

Fruit Growing in Worcestershire

South Worcestershire at the present time probably is unequalled for the extent of commercial gardening in proportion to the total area of land comprised within a radius of 10 ml. of Evesham — which is the centre of this important industry in Worcestershire—or for the excellence in quality and quantity of the crops of fruit and vegetables produced; and the district—probably more than any other—may properly receive the title of "The Garden of England".

Sixty years ago probably not more than 500 ac. of land was devoted to market gardening near Evesham; the area now cultivated for that purpose within a radius of 10 ml. of the town is estimated at upwards of 15,000 ac. This is easily understood when annually several hundreds of acres of land are newly added to that already under market-garden culture; and new men—among whom are young men with public-school education—as frequently devote themselves and their fortunes (large and small) to this frequently profitable enterprise. Moreover, there are many industrious, shrewd, and steady men who were originally labourers working for others and cultivating an allotment for themselves, who now are fully developed market gardeners, owners of house property, and generally well-to-do men. Not the least successful among the best-known market gardeners are men who were previously builders, masons, and clerks.

The pioneers of market gardening were men of well-known names, the best-known being Myatt, Masters, Field, Cole, and Byrd. Mr. Myatt came from the neighbourhood of Camberwell, where he had a market garden, and the writer believes that district is still known as Myatt's Fields. He was the raiser of many standard varieties of vegetables and Strawberries, including "Early Offenham Cabbage", than which practically no other variety is grown in Worcestershire for market purposes. His son, Mr. Charles Myatt, of Harvington, 3 ml. from Evesham, follows in his father's footsteps, and annually grows and sells much seed of this unsurpassed market gardener's Spring Cabbage. Two other good standard varieties of vegetables did Mr. James Myatt raise, viz. "Myatt's Early Prolific" Potato and "Myatt's Victoria" Rhubarb; new varieties of potatoes and rhubarb come and go, but Myatt's varieties are still with us. His best-known Strawberries are "British Queen" and "Eleanor", though he raised other good varieties.

In a handbook bearing the title *Evesham and its Neighbourhood*, reference is made to the gardens in connection with the old Abbey (and to this day called "the Abbey gardens", though they are market gardens) in the following words: "These gardens, which were in cultivation by the monks of Evesham Abbey more than one thousand years ago, formed the beginning of that great market-garden industry which has now become so widely extended in the town and neighbourhood, and gives to the district the title of 'The Garden of England'."

To indicate the scale upon which fruit and vegetables in their respective kinds are grown, the area of land estimated to be allotted to each kind is as follows:—

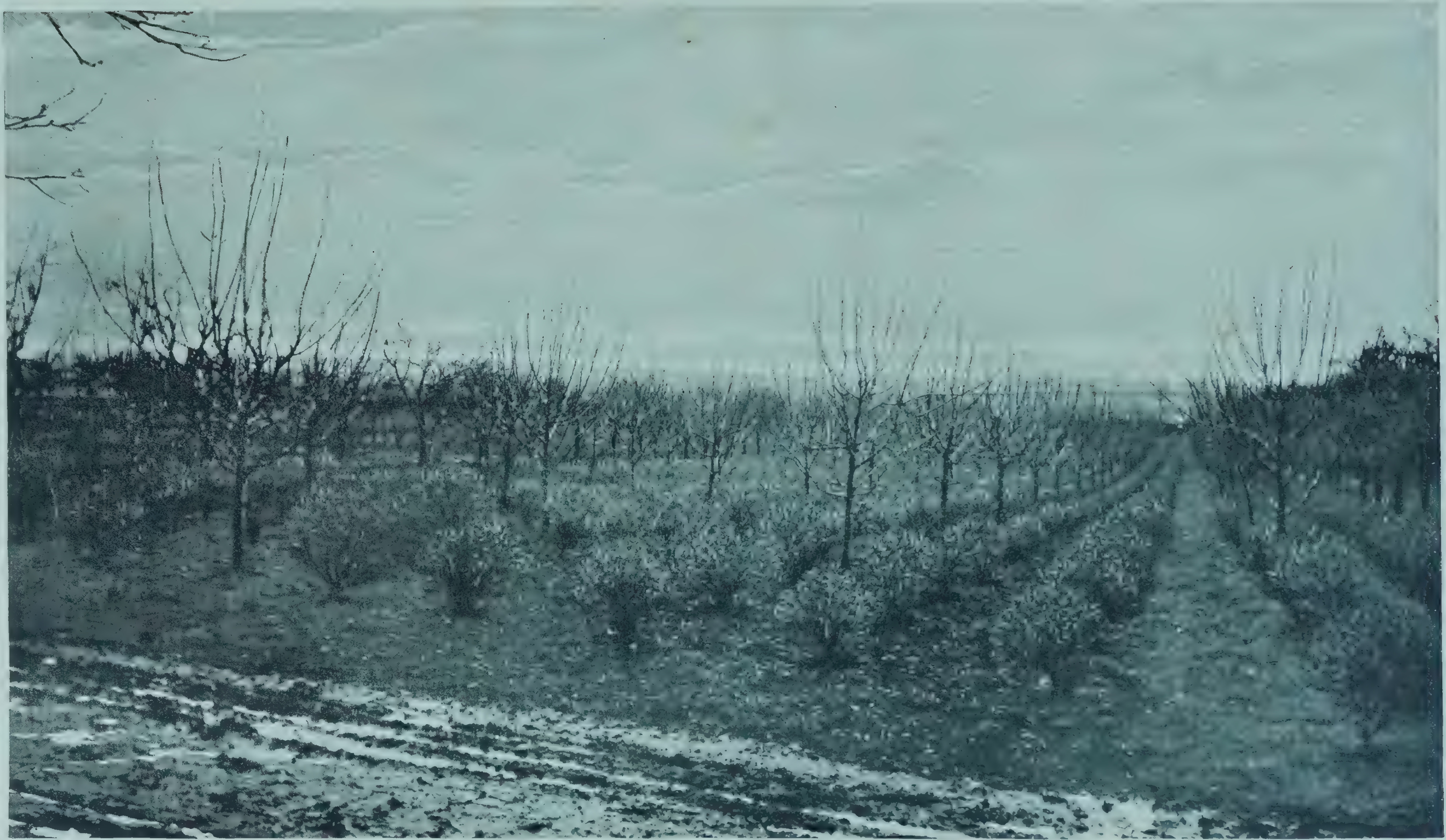
	Ac.
Plums	9000
Apples	3000
Strawberries	2000
Gooseberries	900
Peas	2000–2500
Asparagus	700–1000
Cabbage	1000
Beans (runner)	500
Onions (for use as salad in the early months of the year)	150–200
Marrows	200–250
Radishes	70–80
Lettuce (for use in March and April)	100–120
Tomatoes	250

It must be understood that the fruit trees are mainly distributed over the land in single or double rows at 30 to 40 ft. apart; vegetables, Cucumbers, Marrows, Tomatoes, Asparagus, Strawberries, &c., being grown in the "breadths" between the rows of fruit trees.

In addition there are catch crops of Leeks, Parsnips, Ridge Cucumbers, Broad Beans, Cauliflowers, Jerusalem Artichokes, and Herbs; and small quantities of Currants, Raspberries, and Loganberries. Savoys, Broccoli, and Curled Greens or Borecole are very little grown, seldom being remunerative except where they are consumed locally; then the returns therefrom are very small.

A few flowers are grown also as catch crops, the chief being Wallflowers (Gillies), Narcissi, White Pinks, and Violets. All the above crops are referred to in their proper places in this work.

The Plum being the most important fruit crop in South Worcestershire, it takes precedence of other fruit crops in this article. About 9000 ac. of land are wholly or partly occupied by Plum trees, and they are planted in several ways; sometimes they are planted in whole plantations, the trees being 12 to 15 ft. apart in each direction; others are planted in "belts" of four, six, eight, or ten rows, but the newer market gardens



APPLE ORCHARD AT EVESHAM

Trees 12 ft. apart. Gooseberries as undergrowth. Shelter belt of Damsons on right

have them planted mainly in single or double rows at 30 to 50 ft. apart, the intervening space being cropped in turn with different kinds of vegetables, such as Cabbage, Peas, Beans, Marrows, Radishes, Spring Onions, or Lettuce, whilst other breadths are devoted to Asparagus, Strawberries, or Tomatoes. The rows of trees usually run north and south, the north end or cold end being planted by a narrow belt of Plum trees. Thus the spaces are sheltered and warm, and the crops grown thereon arrive early at maturity or attain a saleable size.

Pruning is done with a heavy hand for a year or two, after which very little pruning is done and little is required; but in the best-managed plantations the trees are looked over annually, though many may not require the knife or saw every year.

The majority of the plantations are under thirty years of age; but here and there older ones are discovered, and their occupants obviously will very soon be destroyed. The Pershore Plum predominates, because it is the most certain cropper, much of the fruit being gathered and sold for culinary use long before it is ripe. The Victoria is also largely grown; and the Damascene has been much used for purpose of shelter, and for its good crops of purple fruit, which usually realizes a good price as the plum season is waning. Another useful Plum (little known in other parts) is one grown locally under the erroneous name of White Magnum Bonum, its proper name being Abricotée de Braunau or Reine Claude Braunau; this is a rather late variety with a drooping habit of growth and the fruit very closely resembles Jefferson in appearance and flavour. The Pershore and Abricotée de Braunau freely reproduce themselves by suckers, which come into bearing without grafting. Other varieties grown largely are Czar, Rivers' Purple Prolific, Heron, and Monarch; and in a less degree Belle de Louvain, Cox's Emperor, and a variety locally known as Jemmy Moore. A purple form of the Pershore is now being freely planted, and it is said to have all the good qualities of its parent.

Apples.—The greater durability of the Apple is causing it to displace in some degree the more quickly perishable Plum; and it is estimated that about 3000 ac. of land are now mainly occupied with young Apple trees. Bush trees are usually planted about 12 ft. apart, the space between them being occupied for the first few years with Currants and Gooseberries. This is a step in the right direction, since the flower of the Apple escapes the frosts which are sometimes so disastrous to the earlier bloom of the Plum, thus securing a crop of one kind of fruit when the other crop has been destroyed.

The varieties chiefly planted are *Worcester Pearmain*, *Devonshire Quarrenden*, *Ecklinville*, *Lord Derby*, *Lord Grosvenor*, *Stirling Castle*, *Cox's Orange Pippin*, *Lane's Prince Albert*, and *Allington Pippin*. At present the Apples of Worcestershire are chiefly produced in another part of the county; the apple orchards of Evesham will tell their story in future years.

Pears are much less grown than Apples in the district of Evesham, which includes all within a radius of 10 ml. But planters are feeling their way with regard to suitable varieties for the purpose; bush trees being chiefly planted. The most suitable varieties appear to be *Pitmaston Duchess, Williams' Bon Chrétien, Clapp's Favourite, Doyenné d'Eté, Doyenné du Comice, Beurré Clairgeau, Beurré d'Amanlis,* and *Marie Louise d'Uccle.*

Gooseberries constitute another important fruit crop in the district. It is estimated that 1000 ac. are grown, largely as an "undercrop" to the Plums, being planted beneath and between the trees; but many are also grown in the open. They are planted in rows about 6 ft. apart and about 5 ft. apart in the rows. The pruning mainly consists of thinning out the branches which are too close, and slightly shortening the young growth if it be more than 8 or 9 in. in length. Occasionally this crop realizes a very high price, but the average may be taken as about £45 per acre.

The varieties chiefly grown are Keepsake, Whinham's Industry, Whitesmith, Crown Bob, Lancashire Lad, and Berry's Early Kent; but the typical Evesham man tries all new varieties of fruit and vegetables which promise improvement upon older varieties.

Strawberries.—These are an important crop in the southern part of the county. It is estimated that there are about 2000 ac. of Strawberries grown in this large district; but it is difficult to obtain an approximately correct estimate. They are usually grown in the breadths between the Plum trees, but many are grown in the open, especially in the outlying districts. The Strawberries are usually planted in rows 3 ft. apart, and the plants 20 in. apart in the rows.

During the first year the Strawberries occupy the ground a catch crop of some kind is taken from between the rows. If the Strawberries be planted in autumn the catch crop may be either Spring Cabbage or early Lettuce; if planted in spring, a crop of Runner Beans kept dwarf, French Beans, or Dwarf Peas may be taken. The Evesham gardeners do not trouble about summer or autumn Cabbage; they do not pay.

For the second and subsequent years the ordinary routine is adopted, viz. forking lightly between the rows after the clearance of weeds and runners, then strawing between the rows in spring just before the flowering period.

The crop is sent to market mainly in handled baskets of 6 lb. each, and in flat boxes containing 12 lb. each; the former largely predominate. The varieties grown are chiefly *Royal Sovereign, Sir Joseph Paxton, Monarch, Stirling Castle* (for jam), and *Bedford Champion.*

The village of Catshill is in the district of North Bromsgrove and lies at the foot of the Licky Hills, which are about 10 miles south of Birmingham. It is a populous village, and up to about 1888 the whole adult population was engaged in making wrought nails. Machinery deprived many of employment, and the village seemed to be on the verge of extinction; but a number of gentlemen near Bromsgrove, interested in the allotment scheme, thought something in that way could be done to stem the tide of distress. Land was obtained and formed into allotments, which were taken up and cultivated by the nail makers. The Worcester County Council acquired a large piece of land and established small holdings there, the tenants in due time becoming the sole owners of the freehold. The two schemes were established and prospered, and a district which was at one time on the brink of ruin has for long been prosperous.

Strawberries are the main crop, and probably there are about 400 ac. devoted, more or less, to that fruit. Raspberries and early Potatoes, and other vegetables, are grown largely. Much of the produce is taken by road into Birmingham, and anyone journeying on the Bristol road between Birmingham and the Licky Hills, in the afternoon of almost any day in the week except Sunday, will see carts and drays returning laden with manure to Catshill. The soil of Catshill is not very good; it is either too sandy on the one hand or too gravelly on the other, and in either case two weeds, troublesome weeds, are sure to be too abundant—couch grass and horse-tail (Equisetum). But poor, difficult, and foul as is much of the land, the nail makers extract a living from it, or supplement their trade earnings therefrom.

Those who have not a conveyance of their own arrange with their more fortunate neighbours to convey to market and sell their produce.

Besides the usual method of growing Strawberries in rows, there are many grown in beds about 3 ft. 6 in. wide, especially on the very sandy soil which has the New Red Sandstone a few inches below. These beds contain three rows of plants, in groups of three, forming a triangle, with a space of about 15 in. between the plants. These beds are allowed to grow to a mass, the plants and runners to produce as much fruit as possible until exhausted, when they are destroyed and other beds take their place.

Dodford is another district for Strawberries near Bromsgrove, and some of the finest fruits sent into Birmingham are grown here. The soil is a clayey loam and suits the Strawberry; but the original method which obtains at Catshill is not practised here. The plants are grown in rows and receive the treatment generally practised.

Raspberries are not largely grown; indeed very few are grown, and there is little to be said about them.

Loganberries.—The demand for this fruit is not yet great, and the supply corresponds. A few are grown at Evesham and Pershore. These are trained to lightly strained horizontal wires, the top wire being about 6 ft. from the ground—higher rather than lower; and the rows are about 6 ft. apart when the Loganberries are kept together. But being a plant of very free growth it pays to keep the rows a good distance apart, and to have another crop between them. Mr. J. F. Hooper, Pershore, is one of the largest growers in the district. This fruit is also very largely grown by Mr. Paget-Norbury, at Malvern, and Mr. J. W. Best, of Suckley. Mr. Norbury arranges his wires in a special way for the Loganberry.

Fruit Growing in the Valley of the Teme.—The Teme valley is probably the most beautiful part of the county of Worcester as well as one of the most fertile in England. It is roughly 20 miles in length and varies from a few hundred yards to a mile and more in width at the lower levels, with steep hills on each side rising to 500 and 800 ft. in places. In this valley are grown practically the whole of the Worcestershire Hops. Here also are grown large quantities of Apples of very good quality, as well as a proportion of Cherries, Pears, Plums, Currants, Gooseberries, and Raspberries, chiefly by farmers and Hop growers, and a large portion of the land is the freehold of the growers. On one small estate there are nearly 250 ac. of fruit; on one farm there are 150 ac., 80 ac. on another, and from 20 to 50 ac. on other farms. It is impossible to give more than an estimate of the area devoted to fruit, but from Tenbury to Worcester—where the Teme joins the Severn—it would hardly be safe to say there are less than 1500 ac., nearly one-half of which are owned by four growers.

The Apples are mainly standard trees on grass; some are on arable land, and a few are grown as half-standards and bushes. The owners are mainly men of brains and capital with up-to-date methods, and they promptly give trial to things that are new if they appear to possess merit of their own. Pruning and spraying receive special attention, and the trees are given care and attention generally.

Another fruit-growing district is that around Ombersley, a district on the east bank of the Severn. Here there are numerous plantations of Plums, Apples, Cherries, Gooseberries, Strawberries, Currants, and Raspberries, and probably about 1000 ac. of land may be accounted for in this way. The methods of cultivation are the same as generally practised elsewhere, and the varieties of fruit are the same.

Thus it will be seen that the total area of land in Worcestershire devoted to fruit culture is very great, the districts already mentioned accounting for about 19,000 ac. If to that be added the smaller areas devoted to the same purpose and distributed all over the county, a total of about 24,000 ac. of fruit will represent the proportion contributed by Worcestershire to the food, wealth, and pleasure of the nation. [J. U.]

SECTION XVII

Commercial Fruit Growing in Scotland

The cultivation of tree fruit has not developed much in Scotland for a long time. Nearly forty years ago there were 1874 ac. Now there are 2108 ac. The cultivation of small fruit, however, has been greatly extended in recent years. In 1897, the first year in which statistics for small fruit were reliable, there were 5214 ac. in Scotland. To-day there are 7260 ac. The total area under fruit culture in Scotland is 9368 ac.

Fruit Districts.—Fruit is grown to a limited extent in almost every county from Caithness to Wigtown, but the bulk of the fruit is grown in the counties of Fife, Midlothian, Haddington, Aberdeen, Forfar, Lanark, and Perth. The following figures show the movement up and down of the industry in these counties since 1897:—

	1897.		1910.	
	Small Fruit. Acres.	Orchard Fruit. Acres.	Small Fruit. Acres.	Orchard Fruit. Acres.
Fife	161	54	206	34
Midlothian ...	268	62	227	66
Haddington ...	392	143	337	94
Aberdeen ...	354	10	335	20
Forfar	197	33	396	23
Lanark ...	1967	722	2102	736
Perth	852	528	2477	560

The Fifeshire orchards are for the most part confined to the village of Newburgh. Small-fruit plantations are scattered over the county. The centre of fruit culture in Forfarshire is Kirriemuir, the "Thrums" of J. M. Barrie's books. The weaver village of other days has become not only a thriving manufacturing town, but a veritable fruit garden. Some years ago the farm of Knowehead, situated on the brae above the village, was purchased and divided into small holdings. Every holding is now a fruit garden. A flourishing Fruit-growers' Association disposes of the fruit. The progress of the movement may be seen from the gross tonnage of fruit dispatched from the Kirriemuir railway station since 1906. These are the figures: 1906, 61 tons; 1908, 110 tons; 1909, 324 tons; 1910, 378 tons. Scotch raspberries are mostly consigned in hundredweight barrels to preservers in the United Kingdom for jam purposes. The fruit growers of Kirriemuir have developed the Raspberry industry along a new and a more profitable line. They are the largest consigners in Scotland of punneted raspberries to the English market. The best-known fruit district in Aberdeenshire is on the banks of the Dee, immediately north of the city of Aberdeen. Specially fine strawberries are grown in this district, which come into the market after the southern strawberries are done. Both Raspberries and Strawberries are grown, though not to a large extent, at Banchory. Mr. Maconochie, once member of Parliament for East Aberdeenshire, was anxious to develop fruit culture in his constituency. It was begun on the low-lying lands of Buchan, but is making little progress. The Lothians are more noted for their market gardens than their fruit fields. Some of the finest market gardens in the country are in the Lothians. Much of the Lothian fruit which finds its way to the Edinburgh market is grown in market gardens. There is only one district, the district round about the village of Ormiston, where there is a congregation of fruit growers.

Lanarkshire.—The fruit-growing counties mentioned are insignificant when compared with the two great fruit-growing counties of Scotland—Lanarkshire and Perthshire. It will be seen from the foregoing figures that there are now 2838 ac. under fruit in Lanarkshire, 736 ac. being devoted to orchards and 2102 ac. to small fruit. Lanarkshire has been a fruit-growing county from time immemorial. The fruit lands extend 14 ml. along the Clyde valley, from Motherwell to the town of Lanark. The valley is narrow and the hills on either side rise rapidly to the ridge. The low-lying land is subject to frost; the higher lands are wind-swept. Many of the orchards are several miles from a railway station. The roads from the valley to the stations are so steep as to be wellnigh impassable. The Clyde valley, however, has its advantages. It is well wooded. The wood provides abundant shelter for the orchard trees. It is also in proximity to Glasgow, the great fruit depot of Scotland. If Lanarkshire is not now the biggest fruit-growing centre of Scotland, it is the most diversified. All kinds of fruit are grown—Apples, Pears, Cherries, Plums, and bush fruit. Raspberries were once grown extensively, but the climate or the soil, or both, seemed unsuitable for their commercial production, and this crop is now a diminishing quantity. Strawberries, on the other hand, seem to be a native of the district. It has been said that 7 tons have been taken off a single acre. The circumstances must either have been very exceptional, or the facts must have been exaggerated. There can be no doubt, however, that heavier crops are grown in the Clyde valley than in any other part of Scotland. Some years ago Tomato growing was almost a rage in Clydesdale. Tomato houses sprang up like mushrooms. Enormous profits were reported. Bad crops and bad prices have had a sobering effect, and the industry will possibly now develop more naturally.

Perthshire.—The greatest fruit-growing county, however, is Perthshire. It had long to take a second place; but it has been steadily pulling up on Lanarkshire, and has now definitely taken the lead. There are 3037 ac. under fruit: 506 ac. of orchards and 2477 ac. of small fruit. The principal orchards are in the Carse of Gowrie, between Perth and Dundee, where Apples are the main crop. The trees are a fine sight in the springtime, when in flower. It is questionable whether the abundant promise is ever fulfilled. Spring frost plays havoc with fruit trees on the low-lying lands of the Carse. The best-known small-fruit district is the Blairgowrie district. Blairgowrie, the centre of the industry, is situated on the lowest slope of the Grampians, looking down on the fertile valley of Strathmore. In the early days of last century it was a village of handloom weavers. In the fullness of time the handloom was laid by and factories were erected on the banks of the River Ericht. They too had their innings. The competition of the towns, with their better railway facilities, and of the jute mills of India, with cheap labour and raw material on the spot, outweighed the attractions of a country life and the advantages of cheap water power, and the manufacture of jute and linen fabrics has for many years been a decaying industry. In the days of its manufacturing prosperity Blairgowrie was famed for Strawberry culture, not because of the extent of the acreage under Strawberries, or the heavy crops—for the acreage was never extensive, and the crops were never heavy—but because of the scarcity and the quality of the fruit. The rapid development of the fruit industry, however, did not take place until twenty-five years ago, when Blairgowrie had ceased to be a thriving town, and Raspberries had become the principal fruit crop. A few years later the Blairgowrie and Rattray Fruitgrowers' Association was formed. It is one of the landmarks in the history of the trade, and the precursor of other associations of a similar kind throughout Scotland. The object of the Association was to eliminate the middleman as far as possible and get into direct touch with the preservers. A secretary and a salesman was appointed with this object in view. At the formation of the society there were only a few members, and the total output the first year was under 20 tons. The association grew with the years, until to-day it has control of hundreds of tons of fruit. Prices were good in those early days, and the enormous crops of Raspberries grown showed that the climate, or the soil—which is light, and not what would be considered good for ordinary agricultural purposes—or both soil and climate, were well suited for the production of this particular fruit. A multitude of men went back to the land—cobblers, bakers, grocers, masons, joiners, manufacturers, lawyers, clergymen. It is significant that, while craftsmen of various kinds became fruit growers, few ploughmen took advantage of the movement to secure for themselves a more permanent position on the land. The reason was, no doubt, in part at least, due to the fact that a ploughman has not usually money enough to enter the fruit trade. The expense of laying down a Raspberry plantation is heavy. The following are normal figures:—

	£	s.	d.	
Preparing the land, which includes ploughing, grubbing, harrowing, drilling, &c.	1	6	0	per acre.
10 tons farmyard manure at 10*s.* per ton	5	0	0	,,
Carting manure to fields	0	6	0	,,
8000 Raspberry canes at £1 per 1000	8	0	0	,,
Spreading manure and planting canes	1	8	0	,,
	16	0	0	,,

In Scotland, larch posts are inserted, not when the bushes are planted, but the following year, along every drill, at a distance of 20 yd. from each other. Wires are attached to the posts, and the canes are spread out and tied to these wires. The cost of this has to be added to the foregoing figures:—

200 posts at 5*d.* each	4	3	4	,,
5 cwt. wire at 12*s.* per hundredweight	3	0	0	,,
Labour connected with the posting and wiring ...	0	13	0	,,
Total...	23	16	4	,,

There are, of course, other items. There is the cleaning of the plantation during the years the fruit bushes are coming into bearing. There is the cost of implements and barrels. There are rent and taxes. By the third year—the year in which the bushes will have become profitable—the grower has expended between £50 and £60 per acre. Every year afterwards the working expenses, apart altogether from rent, taxes, and manure, are a severe strain on a poor man's resources. Manure is put on by a specially constructed horse cart. The manure is covered, and the surface of the ground between the drills, which are 4 ft. 8 in. to 5 ft. apart, is ploughed with a small Oliver plough. Most of the labour, however, is manual labour. The following are the details of the cost per acre of a year's working. The different items vary in different circumstances. Sometimes more work is done by horses and less by men. But the total does not vary much.

	£	s.	d.	
Cutting strings...	0	6	0	per acre.
Cutting out canes	0	15	0	,,
Taking out and carrying off canes	0	7	0	,,
Tying canes	1	2	6	,,
Cleaning ground in autumn	1	0	0	,,
Putting on farmyard manure	0	8	0	,,
Ploughing in autumn	0	5	0	,,
Cutting tops of canes	0	7	0	,,
Ploughing back furrows and cultivating in spring ...	0	5	0	,,
Cleaning twice in summer	1	10	0	,,
Picking fruit—3 tons at £5, 10*s.* per ton	16	10	0	,,
Odd jobs	0	5	0	,,
Total	23	0	6	,,

Despite the inability of the ploughman to take advantage of the experiment, and the large capital needed to enter the trade, there was no lack of prospective fruit growers. Land sold at £100 per acre. It let at £12. The industry went forward by leaps and bounds. The following figures show the net tonnage dispatched from Blairgowrie every year since 1903, and the prices obtained therefor. They include Strawberries, but this crop has become so insignificant that differentiation is unnecessary.

Year.	Tons.	Price.		
1903	1112	at 30*s.*	per cwt.,	£33,360
1904	1254	28*s.*	„	35,112
1905	1412	21*s.*	„	29,652
1906	1807	23*s.* 5*d.*	„	42,313
1907	1871	20*s.* 7*d.*	„	38,511
1908	2006	13*s.*	„	26,078
1909	2664	10*s.*	„	26,640
1910	2492	13*s.*	„	32,396

Essendy.—I must point out, however, that the Blairgowrie tonnage is greatly increased by the fruit grown at Essendy. In 1902 the estate of Drumellie and Essendy, extending to 450 ac., situated 3 ml. west from Blairgowrie, came into the market. The Blair Estates Company, Ltd., was floated, and the estate purchased. A neighbouring proprietor bought 200 ac. of the 450 with the object of securing the rights to Marlee Loch, which bounded the property. The rest of the land, though back-lying, was for the most part good agricultural land, and suitable for the production of fruit. Forty acres were retained by the company. The remainder was divided into small holdings ranging from 5 to 25 ac. The holdings were offered privately for sale at £50 per acre. The price was payable by ten equal yearly instalments, 4 per cent being charged on the unpaid capital. This meant that the purchaser paid, roughly, about £6 per acre per year for ten years. At the end of that time the land belonged to the purchaser absolutely. These were considered at the time good terms in a district where a considerable acreage of fruit land was rented as high as £12 per acre. Before the expiry of a year all the available land was disposed of, although it was some years before it was all under Raspberries.

The scheme was interesting from an agricultural point of view. It was perhaps even more so from a distinctly social point of view. Hitherto the tramp class had been requisitioned in large numbers for securing the fruit harvest. In many respects they were undesirable, and there was strong feeling in the district against them. The Essendy fruit growers decided to pick their fruit by workers to whom no objection could be taken. They erected substantial accommodation, on a co-operative basis, with the financial assistance of the Blair Estates Company Each grower agreed to pay a share of the expenses in proportion to the number of pickers he employed. The accommodation consists of twenty-four houses capable of accommodating about 1000 pickers, and three large dining-halls seated for nearly 1000 people. A restaurant, a grocer's shop, and a post office are kept on the premises. The pickers come from all parts of Scotland. They are engaged by a man appointed for the purpose. Every picker must produce a certificate of character. The season 1910 was a short one, and the pickers were only at work for about six weeks. Notwithstanding this, the catering department, which has a staff of about thirty servants, including a manager and experienced waitresses from Glasgow, sold food to the value of £975. Fortunes are not made, but in addition to the advantage of a month in the country, with decent lodgings and good food, many of the women make money. During their short stay in 1910 they sent through the Post Office between £300 and £400 to their relatives in different parts of the country.

The Essendy growers have also a Fruitgrowers' Association of their own. They have a representative in Blairgowrie, who takes general charge of the sale and dispatch of their fruit. They have a representative in Glasgow, who deals with the traffic going to the West of Scotland, as well as assists in the disposal of the fruit generally throughout the United Kingdom. They have another representative in London, who confines his energies to the sale and delivery of the London consignments. Since the small holdings were created, 2872 tons of raspberries have been sent from Essendy. Notwithstanding the unremunerative prices that have been ruling in the fruit market for the past few years, which have hit the growers at Essendy as well as the growers in every other part of the country, £48,550 has been received for the fruit dispatched. It is needless to say that nothing approximating such a sum could have been obtained from such an acreage in Scotland devoted to ordinary agricultural crops.

Alyth.—The fame of the Essendy experiment in fruit culture soon spread to other parts of the county. Alyth, a village about 5 ml. to the east of Blairgowrie, became the centre of the Raspberry industry in that part of the county. The holdings are mostly held under lease. They extend from ½ ac. to 40 or 50 ac., if the land under cultivation at Jordanstone, some miles from Alyth, be included in the Alyth district. There are now between 100 and 200 ac. under fruit. The Alyth Fruitgrowers' Association sees to the sale and the dispatch of most of the fruit grown. The development of the trade may be seen from the following figures, showing the gross tonnage dispatched from the stations in the vicinity of Alyth since 1906: 1906, 81 tons; 1908, 182 tons; 1909, 451 tons; 1910, 591 tons.

Coupar-Angus.—Coupar-Angus, 4¾ ml. to the south of Blairgowrie, became the centre of another Raspberry district. The holdings in the Coupar-Angus district are on an average somewhat larger than the holdings in the Alyth district. The land, while heavier, is lower lying, and has suffered more in recent years from frost. The trade, however, has developed rapidly, and that notwithstanding a lack of co-operation on the part of the growers. There was for a time a Fruitgrowers' Association in the district. Now most of the fruit is being handled by dealers. These figures show the gross tonnage dispatched from Coupar-Angus in recent years: 1906, 188 tons; 1908, 138 tons; 1909, 610 tons; 1910, 654 tons.

Auchterarder.—The fruit trade was still fairly prosperous in 1907, with no apparent sign of over-production. In that year an extensive scheme was launched in west Perthshire. The farm of Shinafoot, extending to 80 ac., and consisting of light soil, situated about 1½ ml. to the east of Auchterarder station, was purchased. A company, called the Shinafoot Estate Company, Ltd., was floated, which took over the farm. Since then the whole land, with the exception of 4 or 5 ac., has been planted with Raspberries. About the same time the farm of Drumtogle, extending to 220 ac., situated about 2½ ml. from Dunning station, was purchased by a Blairgowrie merchant. The Drumtogle soil is heavier and more retentive than the soil at Shinafoot, but most of it is equally suitable for the production of fruit. The whole farm was divided into small holdings, and sold to purchasers at £50 per acre. The price is payable, as in the Essendy case, by ten equal yearly instalments, with interest at 4 per cent on the unpaid balances. The holdings extend from 2 to 40 ac. With the exception of a few acres under ordinary agricultural crops, practically every holding is planted with Raspberry bushes.

One of the serious problems which the growers in this part of the county had to face was the question of pickers. In some respects it was more serious than it had been in other parts of the county. This was due to the fact that practically the whole area, extending to nearly 300 ac., was laid down at once. There has been, therefore, no gradual development of the industry. Moreover, the population in the surrounding villages is limited. The growers have, therefore, had to depend largely on casual labour. They have erected accommodation for between 1000 and 2000 pickers. Restaurants and grocers' shops have been built at suitable places on the farms. Everything has been done to ensure as far as possible the comfort and the convenience of the pickers, and the expeditious reaping of the harvest.

The growers are associated with the Essendy fruit growers in connection with the sale and dispatch of their fruit. The representative of the Essendy fruit growers at Blairgowrie controls the Auchterarder traffic. He sees it dispatched from Auchterarder station, and supervises the disposal of it to preservers throughout the country. The Glasgow representative of the Essendy Association deals with the Auchterarder traffic going to the West of Scotland, and assists in the disposal of the Auchterarder fruit generally throughout the United Kingdom. The London representative confines his energies to operations in the London market.

Overproduction.—The abnormal development of small-fruit culture in Scotland has had a disastrous effect on the fruit industry. The prices obtained during the years 1908, 1909, and 1910 were not sufficient to meet the expenses of cultivation. It is not possible to say how many acres in full bearing were uprooted in Scotland in 1910, but the land under small fruit in Great Britain was reduced by 2817 ac. The disaster to the industry, regrettable as it is, has had its compensations. It has driven the grower to economize. Excessive dressings of farmyard manure were often applied to the land in the old days just because the grower had plenty of money and never seriously considered whether a heavy dressing was beneficial or detrimental. Manurial experiments have been carried out in Blairgowrie by the East of Scotland Agricultural College, which have gone to show that dressings of 5 tons per acre every year give a better return than dressings of 20 tons per acre. The growers are now profiting by these experiments, and are not so much inclined as they once were to throw money away in the purchase of manure which does no good. This is only one part of the economy now practised. A certain extravagance in the old days characterized the labour bill in connection with most fruit plantations. The labour bill, without detriment to the cultivation of the soil, has now in many cases been greatly reduced.

Conjunction of Industries.—Another change, not less important, has been brought about by the depression in the trade. Fruit growers are not so much inclined now as formerly to have all their eggs in one basket, and, while there is no tendency towards a diversity of fruit crops, there is a decided inclination to conjoin with fruit culture other branches of agriculture suitable to small holdings. The breeding and feeding of pigs, for example, has taken hold of a number of fruit growers. Pig keeping is in the meantime a profitable industry in itself. It is more profitable to the fruit grower than to most other people. His spare time, which might otherwise be wasted, is profitably utilized, and manure can be produced at less cost than it can be purchased. Other growers are devoting their attention to the production of eggs. There may not be a fortune in this branch of agricultural industry. There is more chance of there being a reasonable profit to the fruit grower than to the farmer on the one hand, or to the cottager on the other. The fruit grower has not only time at his disposal, he has the necessary land, for which in any case he has to pay rent. The fowls fertilize the soil and destroy grubs detrimental to fruit bushes. There could not be a better conjunction of industries than the keeping of fowls and the cultivation of fruit. A few growers have made a specialty of bee keeping. Bees have hitherto been kept in fruit districts for fertilizing purposes. They are still being kept for this purpose. But they are also now kept for the production of honey.

[J. M. H.]

SECTION XVIII

Fruit Growing in Ireland

Although Ireland is not at present a fruit-growing country in the same sense that England is, there are great possibilities in store for it under better management. The climate on the whole is much better than that of England or Scotland, and there are districts in the north, south, east, and west that may be regarded as distinctly favourable for the industry. A few years ago Mr. (now Sir Frederick) Moore, Keeper of the Glasnevin Botanic Gardens, discussed this question, and we reproduce, with permission, his remarks from that interesting publication *Irish Gardening*:—

"So much has been spoken and written about fruit-growing in recent years that but little fresh remains to be recorded on this subject, and those not immediately interested in the subject are getting bored and beginning to ask: 'Why all this fuss about fruit?' Those who are directly interested, and who have watched the trend of events, have no reason to feel discouraged at the results which have so accrued, more or less directly stimulated by the flow of speech and ink. The uninitiated may find some difficulty in discovering these results, but the nurseryman, the market salesman, the market grower, the retailer, and the consumer all know and feel that a great and drastic change is taking place in Irish fruit growing and in Irish methods of producing and marketing fruit—a change which is one of gradual advance in the right direction. Only those who have refused to march with the times have cause to grumble, and they fortunately are being gradually crushed out, leaving the field open to more progressive competitors. Perhaps it is not altogether a misfortune that our Irish orchards fell into such a neglected condition during the last half-century. It opened the way for modern systems of cultivation, modern varieties, and a fresh start with young trees. It would be no misfortune if many of the old orchards still remaining were cut down and burnt, and new orchards planted to replace them.

"Many timorous people look aghast at the idea of planting more apple trees in Ireland when they read of the enormous imports of American apples into this country, when they have it officially recorded that there are this year 200,000,000 fruiting apple trees in the United States, which are estimated to yield 4,500,000 bushels of apples for export, chiefly to the United Kingdom; and that in British Columbia alone 20,000 ac. of fruit have been planted within the last twenty years.

"Should these facts really be deterrents to intending planters? They simply prove how great is the market for good fruit and what an opening there is for first-class fruit. Many of these 4,500,000 bushels could be kept out of the United Kingdom, not by protective tariffs, but by supplying our own market with sound home-grown first-quality apples and fruit. A mere surmise! says the sceptic. By no means. Ireland, England, and Scotland are producing double the quantity of good fruit which they produced twenty years ago, and the market price for such good outdoor fruit has steadily gone up, whereas the price of American apples has fallen.

"On the other hand, there is practically no sale for poor or bad fruit, for indifferently packed, or for badly graded fruit, and the consumer and producer are alike benefiting by the change. A few facts to substantiate this. A mixed basket of, say, Ecklinville, Early Victoria, Lord Grosvenor, all good varieties, would if sold as picked from trees, unsorted, and ungraded, scarcely fetch 4*d. to* 6*d.* per dozen. The first week in September first-quality Ecklinvilles sold in the Dublin market at 2*s.* per dozen, second quality sold at 9*d.*, of course all good fruit; a mixed lot of Ecklinvilles, two dozen, containing some apples as good as the first quality, fetched 7*d.* per dozen. These prices are instructive. They certainly are encouraging. Nor is the encouragement confined to cooking apples. Good early apples sell freely and well, and command an excellent and remunerative price. Without leaving the Dublin market numerous instances can be given. Beauty of Bath is a healthy, free-fruiting variety, not given to canker, and succeeding in almost all Apple-growing districts. The fruit is of good quality, attractive in appearance, quite large enough for a dessert apple, firm, and a good traveller. Nicely packed boxes of two dozen brought from 2*s.* to 1*s.* per dozen, according to quality and packing, during the last half of August. In early September boxes of medium Irish Peach, not by any means first quality, brought 1*s.* per dozen, and more were wanted at the price. Many other instances could be given, but those cited will suffice.

"The question so constantly asked, which immediately concerns all interested in progressive horticulture, is: Does fruit growing pay? My answer is: Yes, when properly and well done. Those who do not intend to go thoroughly into it, and to work hard at it, had better leave it alone. Much injury has been done by enthusiastic advocates who have painted in too roseate colours the probabilities and possibilities of fruit growing. £100 per acre is with these gentlemen an ordinary estimate of the profits after a few years, the more moderate putting it at £70. These estimates, for they are only estimates, are illusory and absurd. No doubt under exceptional circumstances £70 per acre on a small plot has been made in one year, but the average profit on an established well-worked fruit farm in this country will not exceed £40 per acre per annum, and it will probably be nearer £30, which cannot be regarded otherwise than as a handsome profit from land, though far removed from the Eldorado many intending growers have been led to expect. One writer of repute states: 'The fruit grower's life is an ideal one'. I can only stigmatize this as a travesty of the facts. The fruit grower's life is a strenuous one and a laborious one, and, to the intelligent and industrious worker, an enjoyable and profitable one.

"The man who plants tall standards in a grass orchard, and then wants to make a decent living out of it, will have a long time to wait. It is often pointed out that in Canada standard trees planted in grass pay well, and that the system, instead of being curtailed, is being extended. In this respect there can be no comparison between Canada and Ireland. The land tenure is different, the climate is different, the market is different, the labour question is different. If fruit farming is to be made to pay in Ireland, the grower must look beyond his apples, pears, plums, and damsons for results. There can now hardly be any two opinions that the only method of fruit farming which pays well is the cultivation of mixed fruits, and even vegetables (in tilled land, not only tilled, but thoroughly tilled and intensely cultivated land, land of which the greatest possible use is made, and none of which is allowed to be unproductive). The weight of fruit got from a given area under this system is not only far in excess of that obtained under older systems, but the quality is infinitely better; and in the fruit markets of to-day, and of the future, quality is the ruling factor. Good varieties must be grown, they must be well grown, the produce must be clean, it must be well packed, and the fruit must be graded.

"The method of cultivation naturally influences the type of fruit tree to be planted and the distance at which the trees are to be planted. In a grass orchard full standards are planted and they must not be nearer than 30 ft. apart. Such standards have no place in a cultivated orchard. Half-standards on crab stock planted 24 ft. apart every way, with a dwarf bush tree on the Paradise stock between each half-standard every way, is the now recognized system of planting. The dwarf or bush trees can be moved away at the end of ten or more years, when the half-standards are getting crowded, and so leave them full room. The object of planting the bushes is to tide over the hungry time, the first six years, and this they certainly do. They come early into bearing, the fruit borne by them is first rate, and they are prolific. There is a general impression that these dwarf bushes on Paradise stock soon wear out, and the quality of the fruit produced by them deteriorates. This is a fallacy. I can point to healthy bushes of such apples as Beauty of Bath, Bramley's Seedling, and Stirling Castle twelve and fifteen years old, which are healthy and vigorous and which bear good crops each year of first-rate fruit. In the spaces between the fruit trees, bush fruit and strawberries must be grown. Gooseberries, currants, raspberries, strawberries, or good vegetables, or if farm produce for home consumption is required, potatoes, turnips, or mangold can also be grown.

"Fruit farms worked on these lines are those which will give in every way the best results. May I just give a couple of instances. In Wexford and Killkenny some acres of mixed fruit were planted in 1904 in single-acre plots, under the supervision of the Department of Agriculture. Accurate accounts have been kept and the plots have been well cultivated. Plot No. 1.—The initial cost of preparing the ground and planting was £20, 15*s.* 4*d.*, and in the first year vegetables and small fruit to the extent of £9, 7*s.* 7*d.* were sold off this plot, leaving a loss of £11, 7*s.* 9*d.* In the second year, 1905, the cost of cultivation was £15, 6*s.* 11*d.*, and produce sold brought £24, 6*s.* 4*d.*, showing a profit of £8, 19*s.* 5*d.* Out of the total receipts of £24, 6*s.* 4*d.*, apples only produced £1, 8*s.* Plot No. 2 cost £12, 10*s.* to cultivate in 1905, and the produce from it was sold for £20, 18*s.* 10*d.*, showing a profit of £8, 8*s.* 10*d.* The apples sold produced £2. Each succeeding year will, of course, show larger profits as the apples, pears, &c., come into bearing. For instance, this last-named plot in 1906, its third year, already shows a clear profit of £23, although apples, &c., still remain to be sold. These are not the best plots; I have selected good average plots, so as to be within the mark, but they sufficiently illustrate the advantages of the mixed system of fruit growing."

The above was submitted to Sir Frederick Moore, who has kindly added the following statement: "I have gone over it carefully. You will see that it was written some six years ago, and experience has taught something since then. On the whole I adhere by the statements made in it. They are substantially accurate. The question as to the distances apart I have modified: 12 ft. every way is too close. We now recommend 15 ft. every way, as that enables better and longer work to be done with horse labour, which is an important matter. I still hold that it is a benefit, where you are growing two types of trees, to grow them mixed. You will notice in my paper I touch on the point you allude to as the duration of bushes on the Paradise stock. I could go further and state that I know of bushes on Paradise twenty-five years old, still producing very fine quality fruit. Further, you must remember we have been dealing with farmers, not skilled fruit growers, men who knew absolutely nothing of fruit and who had to be taught the very elements of it. Each plot consisted of one single acre; many of these farmers have now doubled and trebled the acres at their own expense. The whole thing was an experiment to see if the farmer could be taught to grow fruit well and profitably, and then be left to work out his own destiny. It is succeeding.

"The market-grower question and the market garden are very different matters. The prices given are actual records from these experimental 1-acre plots, but the cost of planting and preparing did *not* include the cost of the trees supplied. The ground was in nearly every instance land under permanent grass, and we could only get the farmers' figures as to cost of preparing. The amount included in cost of preparing and planting also included cost of fencing, which was considerable in some cases. Since the above article was written considerable progress has been made in fruit growing in all parts of Ireland. Farmers have gained knowledge and experience, and are extending their orchards, especially in the north of Ireland. The best varieties of apples for cultivation have been determined, and methods of packing have improved. A vigorous and active association has sprung into existence, called the North of Ireland Fruit Growers' Association, which has done more to improve and standardize apple packing than any amount of literature would have done." [F. W. M.]

SECTION XIX

Diseases of Fruit caused by Fungi; &c.

§ 1. GENERAL

It may be stated at the outset that the various preventive or remedial measures suggested in this article are only intended for use against parasitic fungi, and would not answer for insects, or in many instances might be diametrically opposed to the most approved means by which insects are successfully controlled. There is a very marked difference in the mode of procedure of the person who undertakes to destroy insects and the one who attempts to hold fungi in check; and I think that perhaps the chances of success are greater with the former, for the following reasons. The majority of insects are superficial; for example, hordes of caterpillars, &c.—such can be readily reached and killed. There is no such parallel in the case of the fungi. When an epidemic due to fungi is present, in the great majority the fungus is safely located in the tissues of the leaf, or other part of the plant, and absolutely free from treatment of any kind; hence a case of a cure against a fungus parasite that has once entered the tissues of a plant is unknown, whereas an epidemic resulting from insects may be, and is often, cured.

Coming to preventive methods, or in other words checking the extension of an outbreak, or in preventing its commencement, conditions still favour the destroyer of insects. It is a well-known fact that in the field, as spraying is done on a large scale, it is a very difficult matter to cover every portion of every leaf with the fungicide used. Well, this point is not of such vital importance in the case of dealing with insects as with fungi. The caterpillar, in obtaining its food, moves at a comparatively rapid rate, and sooner or later is certain to eat a portion of the leaf coated with the insecticide, which seals its doom. On the other hand, if the spore of a fungus alights on a portion of the leaf not protected by the fungicide, under favourable conditions it germinates and enters the tissues, and an infection which may spread is set up. If the spore alights on a portion of the leaf covered with the fungicide, of course it is killed at the moment of germination.

A point of great practical importance to cultivators of plants is a clear discrimination between primary and secondary causes of disease. In a great many instances the secondary cause of a disease is by far the most obvious, and in many instances in reality is responsible for the injury done; yet but for a primary cause, often of a very trivial nature, the secondary cause could not have come into being.

The following are illustrations of this condition of things. All the large toadstools and bracket-like fungi so destructive to our orchard and timber trees are known as wound parasites; that is, they can only gain a foothold on the trunk or branch of a tree through a wound. Such wounds may be due to the wind breaking a branch, to a heavy weight of snow, to pruning, &c. In all such cases a wound is produced, and if the scar made by the breaking away of a branch by wind, or by pruning, is left to take care of itself, in all probability some fungus will gain an entrance. On the other hand, if such wounds, as far as practicable, are properly trimmed at once, and thoroughly covered with gas tar, the tree is saved from the attacks of fungi which, if allowed to gain a foothold, speedily work its ruin.

Hundreds of trees die annually in this country for no obvious reason. From an apparently perfectly healthy condition the leaves commence to wilt and turn yellow early in the season. This condition of things may continue for two or three seasons, gradually becoming worse, until eventually the tree dies. In ninety-nine cases out of a hundred, when a tree shows the symptoms described above, death is due to the presence of a fungus that has entered the tree at the collar. Most of the fungi that cause such diseases are wound parasites, as defined above; but, whether this is the case or not, all fungi are ever ready to take advantage of a wound, rather than have to work their way through an unbroken surface to reach the living portion of the plant, from which they can alone obtain food. The spawn or mycelium of such root- or collar-infesting fungi is present in the soil practically everywhere, and rarely loses an opportunity of entering the tissues of a living plant when conditions are favourable for so doing.

The wounds enabling such fungi to gain an entrance into the collar of a tree are due to very varied causes. Over some of these causes we have complete control, if a certain amount of intelligence and care is exercised. In many instances it is certain that hundreds of valuable trees are annually injured, and many eventually killed, by the careless manner in which lawn mowers or grass-cutting machines are handled. A piece of bark from a projecting root, or from the base of the trunk, is torn away. The wound, if noticed at all, is usually covered with soil, so as to hide the scar, and left at that. Fungi present in the soil do the rest. If an accident of this kind does happen, the wound should at once be coated with gas tar. The actual proof that a tree has been, or is being, killed by a fungus in the root or collar is the presence of a white film of spawn or mycelium just under the bark. If a portion of bark is cut away, the white mycelium can be clearly seen. If the disease has not proceeded too far, that is, if it is examined on the first suggestion of wilting or yellowing of the foliage, it may be saved. The soil should be cleared away from the root as far as practicable. The root and base of the trunk should then be thoroughly well dusted over with a mixture of powdered quicklime and sulphur, using twice as much of the former as the latter. Fresh soil should be used in filling up the hole formed, and it should be well sprinkled at intervals with the same mixture of quicklime and sulphur. On examining a tree for the presence of a fungus, if the white mycelium is found between the bark and the wood above the collar, it may be taken for granted that the tree is doomed, and the sooner it is removed the better. The soil should be thoroughly sterilized, by using quicklime and sulphur, before another tree is planted in the same site.

Another very serious source of loss, especially when planting young conifers, is due to the common practice termed "heeling in" the young trees. A hole is made, the young tree placed in position, the earth pushed into the hole and stamped down, the final touches in the way of fixing the young tree being effected by the boot heel, which is stamped down round the stem. In too many instances the heel "barks" the tender young stem, producing a wound, which is promptly utilized either by the "canker fungus" (*Dasyscypha calycina*), if the tree happens to be a larch; or by the root fungus (*Fomes annosus*), which is less fastidious in its choice, so long as its victim is a conifer. Many thousands of young conifers die from the above causes, whereas by the exercise of a certain amount of care the loss could be reduced to a minimum.

The most important factor in combating the many diseases caused by fungi, and the one which invariably yields the best results, is all-round cleanliness. So far as fungi are concerned the significance of this advice cannot be grasped by the cultivator of plants, because the habits and mode of life of the fungi are so different from those of the plants he has to deal with. However, he must accept the facts that when a diseased plant is thrown on the manure heap, and allowed to decay and form manure, the spores of the fungus present in such diseased plant are not destroyed, but are carried back to the land, sooner or later, in a living condition, and ready to infect a future crop. Again, when portions of plants injured by a fungus—potatoes, foliage, &c.—are eaten by animals, the spores are not destroyed, but in many instances are all the better able to germinate after having passed through the alimentary canal of an animal, and when returned to the land in the manure are in a fit condition for infecting any suitable plant. The obvious moral is, burn all diseased plants promptly, and do not pile them in a heap to rot for manure, neither give such as food for cattle or pigs, otherwise the certain result will be an outbreak of the same disease at some later date.

The whole of the space allowed me for discoursing on the diseases of fruit trees generally could easily be occupied in suggesting and indicating weak points which favour the spread of disease. This, however, cannot be; therefore I advise that, in the case of a disease, promptitude, combined with the removal of infected plants from the neighbourhood of healthy ones of the same kind, whenever practicable, will go far towards preventing the outbreak of an epidemic. [G. M.]

§ 2. FUNGICIDES AND SPRAYING

The term fungicide is given to various substances used, in solution or in the form of a powder, for the purpose of killing fungi that are injurious to cultivated plants. Unfortunately the idea of a fungicide for the purpose of preventing plant diseases has in some instances been taken up by parties who, lacking the necessary knowledge, have nevertheless attempted to palm off on the unsuspecting purchaser some quackery, in many instances surpassing, if possible, the nostrums meted out by certain parties as an antidote to all the ills that human beings ever have suffered or ever will suffer from.

From amongst the many fungicides known, Bordeaux mixture and self-boiled lime-sulphur mixture are undoubtedly the best, and will meet all requirements.

Bordeaux Mixture.—This fungicide consists of a mixture of sulphate of copper (bluestone), quicklime, and water in the following proportions:—

Sulphate of copper	16 lb.
Quicklime	11 „
Water	100 gall.

Place the sulphate of copper in a coarse sack, and hang it just below the surface of a few gallons of water in a cask until melted. In another cask slake the lime gradually until it is reduced to a creamy consistency. When both are thoroughly dissolved, each should be made up to 50 gall. with water. Then pour the milk of lime and the solution of sulphate of copper slowly into one vessel, and stir the whole thoroughly for five minutes.

For determining whether the mixture is safe to use, the usual test is to place the blade of a knife in the solution for one minute. If the blade remains unchanged, the solution is safe to use; but if the blade becomes coated with copper, more milk of lime should be added. A more certain test for the presence of free copper in the mixture is to put a few drops of a solution of potassium ferrocyanide, along with some water, into a white saucer, and to drop into this some of the clear Bordeaux mixture. If the liquid becomes red or brown it shows that there is copper in solution; whereas if there is no change of colour, the mixture is safe to use. The addition of lime, as before, corrects the mixture.

The preparation of Bordeaux mixture is given because it is very important to remember that the home-made material is much superior to any of the commercial mixtures on sale. It must also be borne in mind that reliable Bordeaux mixture can only be made from good materials. Sulphate of copper is often adulterated with other substances, more especially with sulphate of iron, which is useless as a fungicide. In purchasing sulphate of copper, 98 per cent purity should be insisted upon. The quality of the lime is also an important point. It should be quicklime in the proper sense; partly air-slaked lime results in scorched foliage. The lime should be in lumps, and when slaked should form a creamy mass devoid of lumps and grit, otherwise the nozzle of the spraying machine will become clogged.

A modified method of preparing Bordeaux mixture has recently been devised by Mr. Spencer U. Pickering, F.R.S., of the Woburn Experimental Fruit Farm, which promises to supersede the older method. The point of difference consists in using lime water instead of milk of lime or dissolved lime. This results in a clear liquid which cannot clog the nozzle of the sprayer. It acts at once as a fungicide; whereas ordinary Bordeaux mixture has no fungicidal action until it has been on the foliage for some days. Finally, there is less danger of scorching. It is prepared as follows: Dissolve 6 lb. of sulphate of copper, in the way advised under Bordeaux mixture, in a wooden or earthenware vessel. Take 3 lb. of good quicklime and slake it in a little water; then put it into a tub with 120 gall. of soft water. Stir thoroughly, then leave the mixture to settle. The clear liquid is known as lime water. Add this lime water to the dissolved sulphate of copper to make up 100 gall. This will have the same strength as the Bordeaux mixture previously described. The same test should be applied to find out whether it is safe to use without scorching the foliage. If copper is found to be present, add more lime water.

Self-boiled Lime-sulphur Mixture.—It is well known that Bordeaux mixture cannot be used for spraying Peach trees, because, even when diluted beyond the point of being of any value as a fungicide, it yet scorches and destroys the foliage of trees growing in the open; whereas, when the trees are grown under glass, as in this country, the foliage is, as a rule, softer and yet more liable to injury. The leaves of Almond trees and some others also suffer from the application of Bordeaux mixture. A browning or russeting of apples also often results from the use of the above-mentioned fungicide.

In view of these facts, Dr. W. M. Scott, of the United States Department of Agriculture, has, after repeated experiments, devised a fungicide which can be used with safety on trees having delicate foliage, and which, as a fungicide, is nearly of equal value to Bordeaux mixture. The ingredients used are as follows:—

Quicklime	8 lb.
Sulphur	8 ,,
Water	50 gall.

Place the lime in a barrel, and pour on 1 gall. of water to start it slaking. Then add the sulphur in the form of a fine powder, adding more water to slake the lime into a paste. Continuous stirring is necessary to prevent the mass caking at the bottom. After the violent boiling—which results from the slaking of the lime—is over, which occupies from five minutes to a quarter of an hour, depending on the quick or sluggish acting of the lime, add sufficient water to stop the boiling, and make up to 50 gall. with water when required for use.

Before commencing spraying, the mixture should be strained to remove the gritty particles of lime; but all the sulphur should be rubbed through the sieve. The mixture should be kept well stirred when spraying, as it settles rather quickly.

Paris green, for the destruction of insects, may be mixed with this fungicide when used for spraying Apples, but should not be used for Peach trees. Paris green may also be added to Bordeaux mixture.

Sulphide of Potassium Solution.—Sulphide of potassium, or "liver of sulphur", is an excellent fungicide for use against the superficial mildews, as Apple-tree mildew, Rose mildew, Hop mildew, &c. It is of especial use in checking the spread of a disease in greenhouses, &c., but it must be borne in mind that the solution discolours white paint. It is readily soluble in water, and may be used in the proportions of 2 to 3 oz. to 3 gall. of water, depending on the relative hardness of the foliage. One ounce to 3 gall. of water is, as a rule, strong enough for plants grown under glass.

Winter Spraying.—Where disease has previously existed it is often advisable to spray during the winter months, when vegetation is in a dormant condition. Under such circumstances a much stronger solution can be used without risk. The Woburn Winter Wash (B) is perhaps the best all-round winter wash to use, as it destroys all moss and lichens, thus removing the shelter required by numerous insects; it also kills the mussel and oyster-shell bark lice, in addition to destroying the spores of the Apple-scab fungus present on dead branches.

Its composition is as follows:—

Sulphate of copper (bluestone) ...	1½	lb.
Lime	½	,,
Paraffin	5	pt.
Caustic soda	2	lb.
Water	10	gall.

Dissolve the bluestone in a few gallons of water; slake the lime in water and add to the dissolved bluestone, straining it to remove all grit; then add the paraffin and stir thoroughly. Finally add the caustic soda dissolved, along with water to make up 10 gall.

The trees should be thoroughly drenched. The ground may also be treated with advantage.

It is most important to remember that the above wash should only be used during the winter months, before the buds commence to swell.

Gumming.—This exceedingly common, yet ill-understood disease attacks Plums, Cherries, Peaches, &c.; in fact all the Pruneæ, or trees bearing stone fruit, suffer. Small drops or tears of gum first show on the trunk or branches, and gradually increase in size until quite large masses of gum accumulate on the surface of the diseased parts. As the disease progresses, the fruit also shows gumming, several large masses being often present on a plum.

The gum consists of the tissues which have become dissolved, owing to the presence of an enzyme, and is not readily soluble in water, after being exposed to the air.

Probably no other single plant disease has been investigated more frequently, or more thoroughly, than gumming, or "gummosis" as it is frequently called, yet the various results are so diametrically opposed that it may be concluded that the true cause is as yet unknown.

If we concede that the cause of the disease is unknown it cannot be expected that a cure can be given; yet, following the rule-of-thumb method of first trying one thing then another, the fact has been arrived at that the best-known remedy is common salt. This should be sprinkled on the ground as far as the roots extend in the soil, at intervals, from 3 to 4 lb. of salt being used in a year. [G. M.]

§ 3. SMUDGING

What has been called "Smudging" is an exceedingly inelegant name for the process of preventing damage to the fruit crop through frost in early spring by means of a smother of smoke, or by maintaining the temperature above the danger point with fires placed about among the fruit trees, or by a combination of both.

The idea has come from the exceedingly wideawake fruit growers of America, whence most of the processes now on the market have also been imported. From the valleys of California and the irrigated plateaux of Colorado come wonderful accounts of whole populations turning out at midnight, on electric summons from the mayors, and all, without distinction of rank or calling, joining in "fighting the frost"; returning, after sunrise, begrimed and fatigued, but victorious over the foe that otherwise would have swept the orchards clean of any promise of fruit.

The prospect is an attractive one. The danger of losing all through a spring frost has been a sort of nightmare to fruit growers as far back as the days of Shakespeare, who puts into the mouth of the fallen Wolsey the words:

> "This is the state of man: to-day he puts forth
> The tender leaves of hope; to-morrow blossoms, . . .
> The third day comes a frost, a killing frost; . . .
> And then he falls. . . .
> And when he falls, he falls like Lucifer,
> Never to hope again."

On an average it is estimated that in two years out of five the fruit crop in England is a failure, and nearly always the immediate agent of the destruction seems to be frost.

If, therefore, it is argued, the fruit crop could be effectively protected against frost, instead of the uncertainty which at present is so unpleasant a factor in fruit growing in this country, there would be the reasonable prospect of regular crops, and commercial arrangements such as at present are impossible could be made for dealing with them. Another result would be, it is claimed, that fruit growers, assured of continuous crops, would thin systematically and a better quality of fruit would be put on the market, instead of being tempted, as now, to leave on the trees all the fruit that comes when there *is* a crop, from fear of losing any of it.

For two years various devices have been advertised in this country. Several demonstrations have been held, and some growers have purchased experimental quantities, but up to now not one of the processes can advance the recommendation which, it appears, can be advanced at the other side of the Atlantic, viz. that it has saved a crop. Until this can be said the adoption of any of them will naturally be slow. Those who have already tried smudging are unable to say that the crop was appreciably heavier where it was applied than where it was not. It is an ill task to decry a new invention—and every succeeding generation has provided its own confirmation of the stupidity of the mental attitude that says "it can't be done"—but it may be permitted to point out that it is at least unwise to promise as good results here as are reported to have been obtained in America. The difference in climate and atmosphere between a comparatively small island like ours and a vast continent like America is considerable and must be taken into account. Many modifications may be necessary before devices which may be successful in America become suited to our requirements.

Again, it is held by competent observers that the fruit crop is made or marred in the autumn, and that though the frost in spring appears to work the destruction, it is really only the sword of the Assyrian executing the doom pronounced in the autumn.

The wet, almost sunless autumn of 1909, for instance, prevented the proper ripening of the wood, so that the blossom in spring was debilitated and lacked stamina sufficient to withstand the buffeting of what Thomson called the "ethereal mildness". Notwithstanding, there have been occasions when a healthy promising prospect has been marred by one severe frost, and if a workable weapon of defence can be placed in the grower's hands it cannot fail to be of great advantage.

The introduction of methods of smudging is too recent to admit of the cost of working being clearly ascertained. Apart from the cost of installing plant, which will be from £7, 10*s.* to £10 per acre, the cost of keeping the fires in action for a single night is about 25*s.* for 1 ac.

[W. G. L.]

SECTION XX

Grading and Packing Fruit

The grading and packing of fruit, it may be said without fear of contradiction, are becoming more important matters for the grower every year.

No one who takes a walk round any fruit market during the home-fruit season can doubt that very much yet remains to be learnt, and more to be practised, before the goal of perfection comes into sight. In the case of apples and pears, and the better sorts of plums, careful grading into "firsts", "seconds", and "thirds", and the putting of all "specks" by themselves is essential if anything near the upper ranges of price is to be reached. The "firsts" will pay for tasty setting up. The cherries, gages, and pears of our French neighbours are splendid examples of what taste and skill can accomplish in setting fruit off to advantage. It is wonderful what a little paper, wood wool, and deft fingers can do, and how ready the public are to pay for it (fig. 328). Then, as to packages, a steady, silent revolution is taking place in regard to these also. Time was when Hessle pears were brought to Covent Garden from Fulham in load "baskets" holding 4 bus. each!

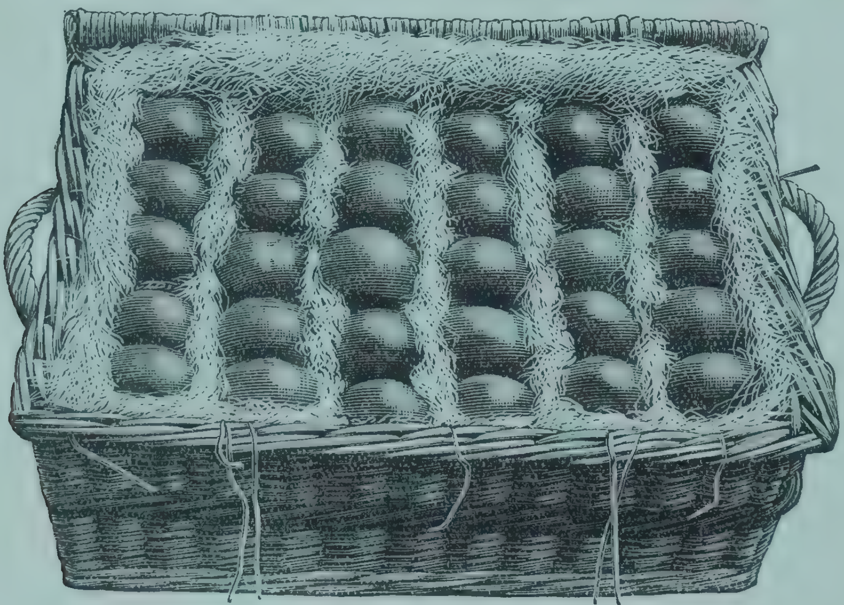
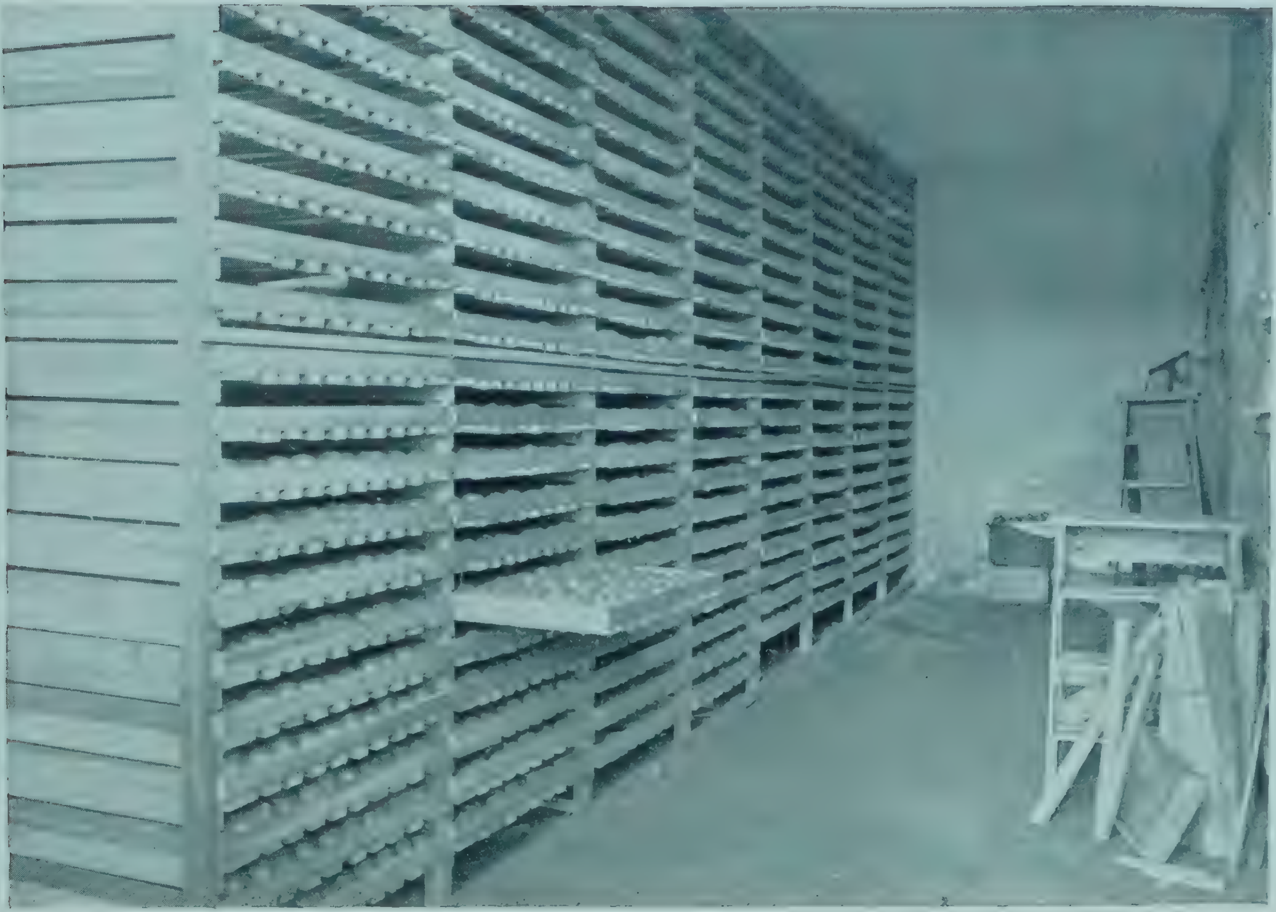


Fig. 328.—Apples in Flat Basket with Lid. Packed with fine wood wool



FRUIT ROOM WITH APPLES STORED IN WOODEN TRAYS

Each tray contains a bushel of apples, and there are 614 trays in the room

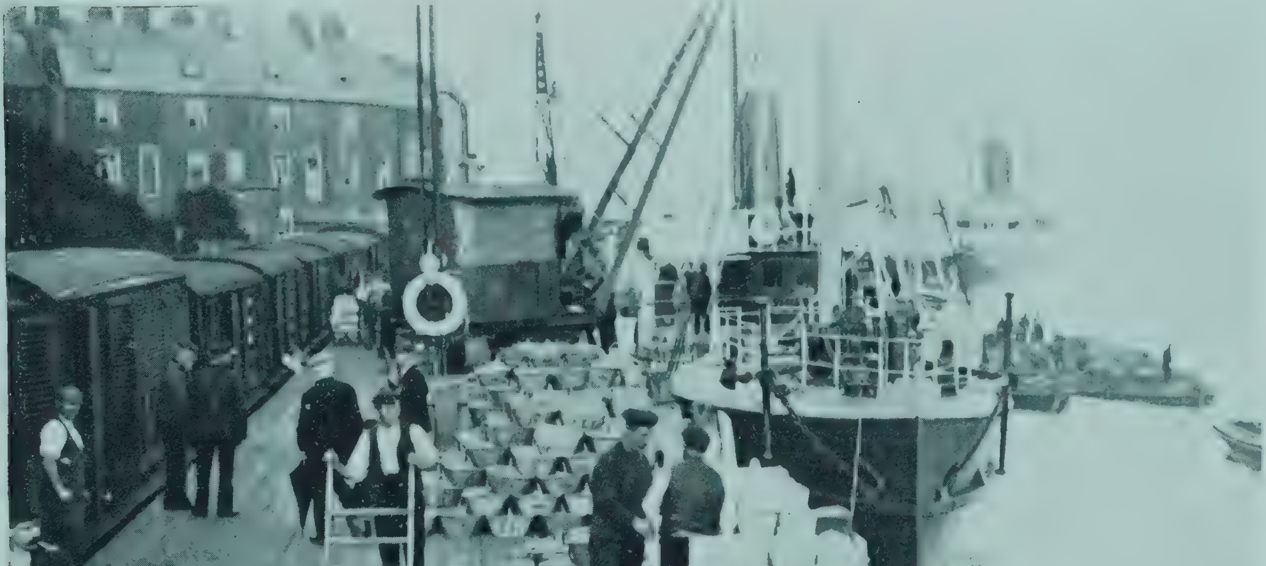


Photo. Chas. L. Clarke

UNLOADING GRAPES AND TOMATOES

Brought from the Channel Islands to Weymouth

With profound apologies to our Evesham friends and their "pot", it may be said with confidence that a bushel is the largest measure in which fruit of any kind should be sent to market, and this only for cooking apples and the harder sorts of pear. For plums, dessert apples, and the better kinds of pear the ½-bus. is the largest measure that should be used; for ripe plums a smaller measure still is desirable, and where apples and pears are grown clean and good there should be many that it will pay to send up in single-layer trays to be sold by the dozen.

Where fruit has to be sent long distances the inconvenience and expense of returning empties has turned many minds to the task of devising a package which shall be strong enough to stand the knocking about of travel, and yet be low enough in price to admit of being given away with the fruit; thus have come about what are called "non-returnables".

From the point of view of the grower who provides his own baskets the question is one for serious consideration. What happens to the baskets is generally this: the grower sells his fruit at market to a "packer", who sends it away to retailers at seaside places or provincial towns, leaving with the grower 1*s.* on each basket. The retailer has purchased an orchard or two of fruit of the kind one sees close to almost every farmhouse in the country. When he has sold the fruit out of the basket received from the sender he keeps it and uses it for gathering his purchased fruit. It is true he has left 1*s.* on it with the packer; but there is no time limit, and he can get his shilling back whenever he returns the basket, so long as it can just hold together enough to be called a basket. Consequently, when all his purchased fruit has been disposed of, and when the basket which he received from the packer new is more than three parts worn out, he sends it back and claims his shilling. The grower, about mid-winter, when marketings are slack and funds low, gets numbers of rickety baskets back which went out of his place new, and out of which he has only had the use of one journey, each one carrying a demand for a shilling. All through his busy season he has had to keep supplying new baskets for his fruit. It is no wonder, therefore, that the idea of non-returnables found the grower ready to regard it as a business proposition. To get rid of the "empty" question was worth giving away a fourpenny box with a half-bushel of fruit and a sixpenny one with a bushel; if competition brought the prices lower, so much the better. For the packer, one cannot imagine a more desirable reform. In the case of fruit in baskets he must provide packing and staves, and men to stave each basket securely down in the vain endeavour to guard against "plunging", as pilfering *en route* is called. With the non-returnable box the whole of this is saved, plundering is impossible, and, last but not least, the anxiety, expense, and trouble of dealing with empties is entirely obviated. For the retailer at the other end the fruit comes in a non-resilient package and consequently less liable to damage in transit from rubbing. The package is good enough, when empty, to go several times to get fruit from his purchased orchards, and can afterwards be used for the humble but necessary purpose of lighting the domestic fire, and he is saved the locking up of his capital in the shillings deposited on. Most of the packages bear a name or mark indicating the grower from which they come, so that if one should be foolish enough or rogue enough to use the nail-down package to cover careless or dishonest packing, the buyer can guard against being twice bitten, while if one mark suits him better than another he can arrange with the packer to send him that one in preference to another.

No one can say that the advantages claimed above for the non-returnable are either imaginary or inconsequential, yet it will hardly be believed that during the autumn of 1910 packers were paying 5*s.* 6*d.* and 6*s.* per bushel for Hessle pears in baskets, and were refusing to give more than 5*s.* for pears of an equally good sample in bushel boxes, each of which held more than a basket, and notwithstanding the expense and labour of packing and staking entailed by the baskets. One large packer showed a grower letters and telegrams from Yorkshire and Lancashire asking for Monarch plums in baskets *not* in boxes. There was no question of preferring a certain mark in baskets to another in boxes; the preference was for the plums in baskets.

It is a commonplace of literature and conversation to gird at the farmer for his preference for the continuance of things as they were, and some of the shots, ricochetting, hit the market gardener; but the tendency thrives luxuriantly behind the counter of the retailer as well. No one who has not tried it, knows the difficulty and loss entailed to the man who endeavours to get some improvement in package, packing, or dealing accepted by the retail trade. When first the non-returnable plum box appeared on a grower's stand, one of the largest and most experienced of the Covent Garden fruit merchants said to him: "Yes, they are bound to come *in time*; but take my advice, don't be a pioneer, it doesn't pay. Let somebody else do that, and you follow!" [W. G. L.]

SECTION XXI

Pip Fruits: Apples, Pears, Quinces, Medlars

APPLES

§ 1. GENERAL

The Apple is far and away the most important of hardy fruits grown by market gardeners in the British Islands. Originally springing from the Wild Crab Apple (*Pyrus Malus*), fig. 329, it has undergone such a transformation in the course of centuries of cultivation and selection that the many excellent varieties now known bear but very little resemblance to their wild progenitor except in mere outline. The fruits of the Wild Crab Apple are 1 in. or a little more in diameter, yellowish when ripe, and bitterly sour in flavour. The leaves are 1 to 2 in. long, oblong-rounded in shape, tapering at the apex, and irregularly toothed on the margins; and the umbels of pink-and-white flowers usually appear in May.

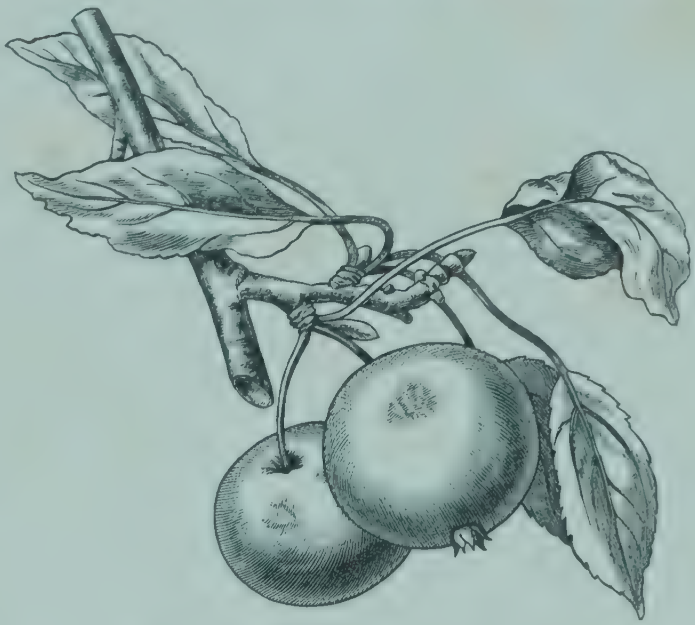


Fig. 329.—Crab Apple (*Pyrus Malus*). (½.)

Being distributed in a wild state throughout the temperate regions of the Northern Hemisphere, it is natural that a good deal of variation should exist, and to this circumstance is probably due the fact that in the hands of the gardener the Crab Apple has lent itself so readily to modification and improvement. For generations such improvements as took place were purely accidental, the result of chance seedlings, and the history of some of the oldest known varieties is lost in obscurity.

It is said that the "Old English Pearmain" is the oldest known English Apple on record, having been cultivated in Norfolk before the year 1200. The "Costard Apple", which is said to have given the name of costardmonger or costermonger to vendors of it, was known in the thirteenth century; while other old English Apples, like the Catshead, the English Codlin, Golden Pippin, Golden Reinette, the Joanetting, &c., were not recorded until the sixteenth and seventeenth centuries.

It was not, however, until the end of the eighteenth and the beginning of the nineteenth century that anything like a systematic attempt was made in England to improve the different varieties of Apple. Thomas Andrew Knight (born 10 October, 1758, died 11 May, 1838), paid special attention to the Apple, and infused a spirit of higher methods of cultivation and selection into the pomologists of his day. Since his time still greater advances have been made. Gardeners have a far better knowledge of the principles underlying hybridization and cross-fertilization, and more scientific methods are adopted for raising new varieties of excellence. Notwithstanding this, it must be admitted that many of the older kinds of apples, about whose parentage little or nothing is known, are still in the front rank. In private gardens a far larger variety of kinds is to be found than in market gardens, for the simple reason that once the latter are planted, from 50 to 100 years or more may elapse before newer and better varieties may take their place.

Area under Cultivation.—From the statistics published by the Board of Agriculture in England, and the Department of Agriculture and Technical Instruction in Ireland, it appears that, out of a total of 77,836,769 ac., about 178,548 ac. of land in the United Kingdom are planted with Apple trees. England, with an area of 32,527,070 ac., is far and away ahead of either Scotland, Ireland, or Wales, having about 168,762 ac. out of the whole. Ireland, with an area of 20,819,928 ac., comes next with 5797 ac.; then Wales, with an area of 4,712,281 ac., has 3087 ac.; while Scotland, with an area of 19,777,490 ac., has only 901 ac. under Apple cultivation. The latest returns (1911) show 166,522 ac. for England, 2841 ac. for Wales, and 789 ac. for Scotland; so that there has been a decrease in the area of Apple culture of about 2600 ac. in a couple of years in Great Britain. It is easy to understand why Scotland should have so small an acreage. The climate is more severe and the soil more unsuitable in many parts; and the difficulty of transit to distant markets has no doubt also had an influence in keeping Apple culture down. In Ireland, where the climate is much more genial, and where Apples could be grown in almost every part, there is probably a great future for the industry once economic conditions begin to improve and emigration begins to subside.

Considering its mountainous character, and the fact that it is only about one-eighth the size of England, Wales has a very fair acreage under Apples.

Taking the counties of England, the following figures show centres where Apples are most largely grown:—

County.	Area in Acres.	Apple Area in Acres.	County.	Area in Acres.	Apple Area in Acres.
Devon	1,655,208	26,575	Hampshire	1,037,764	1,431
Somerset	1,049,812	25,080	Suffolk	944,060	1,394
Hereford	532,918	24,448	Surrey	485,129	1,352
Kent	995,392	13,089	Essex	987,032	1,317
Gloucester	783,699	13,086	Nottingham	527,752	1,277
Worcester	472,453	12,931	Bucks	477,151	1,072
Cornwall	863,665	4,865	Middlesex	181,317	1,028
Dorset	627,265	4,346	Chester	657,123	1,012
Shropshire	844,565	3,962	Hertford	405,141	966
Norfolk	1,356,173	3,077	Derby	658,624	708
Monmouth	370,350	3,578	Leicester	511,907	665
Wiltshire	866,677	3,527	Northampton	629,912	672
Sussex	933,269	2,610	Stafford	748,433	584
Lancaster	1,208,154	1,931	Bedford	294,983	483
Cambridge	524,935	1,921	Huntingdon	229,515	337
York	3,882,851	1,887	Cumberland	970,161	279
Warwick	566,271	1,752	Westmorland	500,906	190
Berkshire	462,210	1,742	Durham	647,592	94
Lincoln	1,767,879	1,736	Northumberland	1,290,312	59
Oxford	483,621	1,533	Rutland	94,889	55

From the above table it will be seen that six counties — Devon, Somerset, Hereford, Kent, Gloucester, and Worcester—having an area of 5,489,482 ac., devote 115,209 ac. to the cultivation of Apples, or nearly 65 per cent of the total Apple area of the United Kingdom. According to the latest returns this area has been reduced by about 390 ac. to a total of 114,919. There are over 973 ac. less in Somerset, and 333 ac. in Gloucester, but there have been increases in Kent, Worcester, and Hereford.

Of the 5797 ac. devoted to Apple culture in Ireland the province of Ulster absorbs 3638 ac., and of these there are 2463 ac. in the county of Armagh alone. The province of Munster has 1151 ac., of which 435 are in the county of Cork. The province of Leinster comes third with 784 ac.; and Connaught, with 224 ac., last.

In Wales the most important Apple-growing county is Brecon, with 1120 ac. Radnor, with 706 ac., comes second, and Montgomery, with 502 ac., third. The other counties vary from a minimum of 13 ac. in Anglesey to a maximum of 262 ac. in Glamorgan. Of the Scottish counties, Perth is a long way ahead, with 355 ac., the next largest Apple county being Lanark, with 138 ac. Apples are least grown in Sutherland, Nairn, Bute, and Peebles, the first-named having a record of only ½ ac., and the last named 1¾ ac. On the whole Wales has declined by 246 acres up to the end of 1911; and Scotland by 112 acres.

In addition to Great Britain and Ireland, the Isle of Man has 37 ac., Jersey, 1055 ac., and Guernsey and the other Channel Islands, 136 ac.

Taking the United Kingdom and the Channel Islands together we have an area in round figures of 170,000 ac. at the end of 1911, against 179,700 ac. at the end of 1908, upon which Apples are grown. Assuming that there are only 160 trees planted on each acre of land, this would give the total number of Apple trees for the area mentioned as 27,200,000. It may be taken for granted, however, that there are very few market gardens at any rate, although there are many orchards, in which Apple trees are planted a rod apart. It is probable, therefore, that there are at least more like 35,000,000 Apple trees in cultivation. Taking an average crop of 2 bus. of fruit per tree, the annual crop would be 70,000,000 bus., or nearly 1½ bus. per head of the entire population. Reckoning 40 lb. of apples to the bushel, the total annual crop represents a yield of 1,250,000 tons of produce taken off the land, or just over 6 tons of fruit per acre.

So far as the value is concerned, if reckoned at the rate of £10 per ton, the total apple crop of the United Kingdom and Channel Islands is worth about £7,500,000 sterling per annum. This is not really much, and if better methods of cultivation were more generally adopted there ought to be no difficulty in doubling the crop of apples, so as to make it worth £15,000,000 sterling. In 1908 the importation of apples was valued at £2,079,703, but there is probably a great difference between the "declared value" and that actually realized.

§ 2. APPLES AND MIXED CROPS

Very rarely indeed are Apples grown alone. They are usually undercropped with Gooseberries, Currants, or Raspberries, and sometimes entirely with vegetable crops like Rhubarb. The above diagram (fig. 330), taken from an actual market garden, shows how some growers crop their ground.

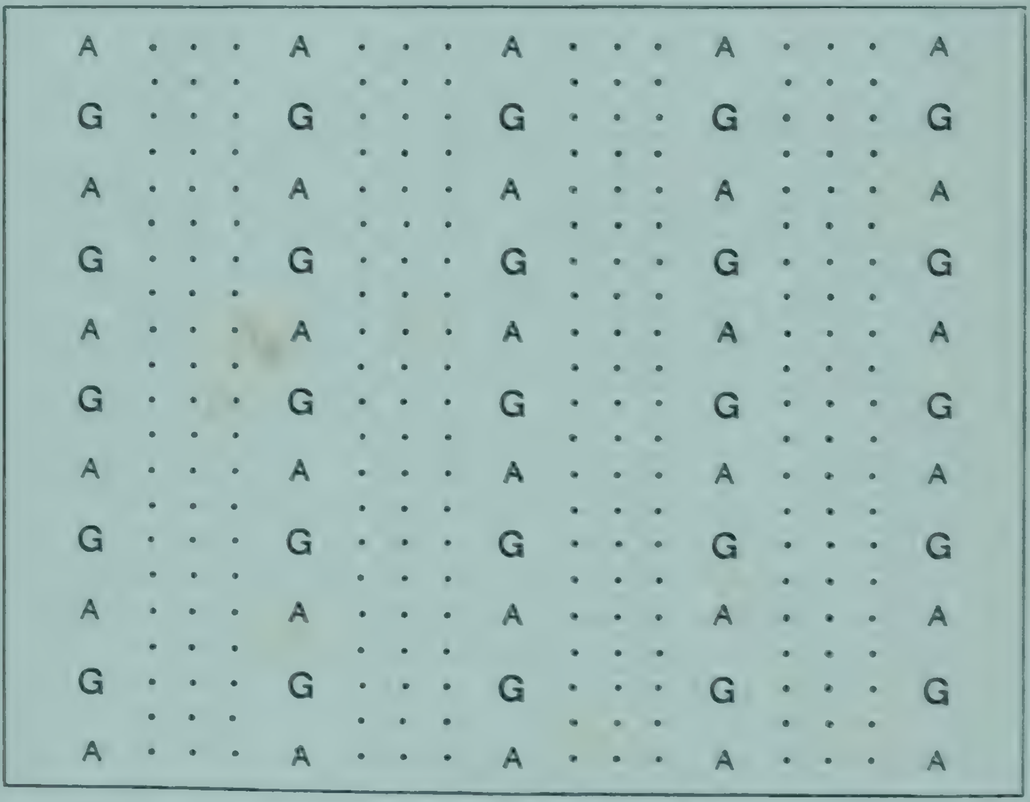

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Fig. 330.—Arrangement of Apple Trees, with Gooseberry Bushes, &c., between

The Apple trees in this case, represented in the diagram by the letter A, are grown as bushes at 10 ft. apart every way, making about 435 to the acre. Between them one Gooseberry bush (White Lion), represented by the letter G, is planted, giving also 435 plants to the acre. In between the rows catch crops of such vegetables as Cabbage, Lettuce, Spinach, Leeks, Potatoes, &c., are taken in the rows running north and south.

Apples grown in this way, when properly pruned and cared for, bear from 20 to 60 lb. of fruit in their sixth and seventh years. It might therefore be assumed that when ten years of age there would be an average of 1 bus. of fruit (40 lb.) on each tree every year, making a total of 435 bus. (or 17,400 lb.) of good fruit. At 3*s.* per bushel this represents a gross revenue of £65, 5*s.* per acre for the Apples alone.

To this must be added the Gooseberries. It may be assumed that half a sieve or ½ bus. would be a fair crop for a well-established bush. Reckoning 30 lb. to the half-sieve, the yield of gooseberries would be 12,050 lb., something over 5 tons to the acre. At an average price of 1*s.* 6*d.* per half-sieve, the gooseberry crop would realize £32, 12*s.* 6*d.* The Apples and Gooseberries therefore together yield a gross return of £97, 17*s.* 6*d.* The vegetable catch crops, in the first few years at any rate, would realize sufficient to pay the expenses of labour, and this latter item might be put down roughly at £20 per acre per annum.

If Red Currants were grown instead of Gooseberries, the average crop from established plants might be reckoned at 3 tons to the acre, and as these are usually worth £10 to £12 or more per ton, the receipts would be somewhat higher.

Black Currants would be a still more valuable crop, assuming that they were fairly free from attacks of "big bud" (see p. 157); 435 bushes to the acre should yield, say, 3 tons of fruit, which, at £20 a ton, would be about twice as lucrative as the Red Currants.

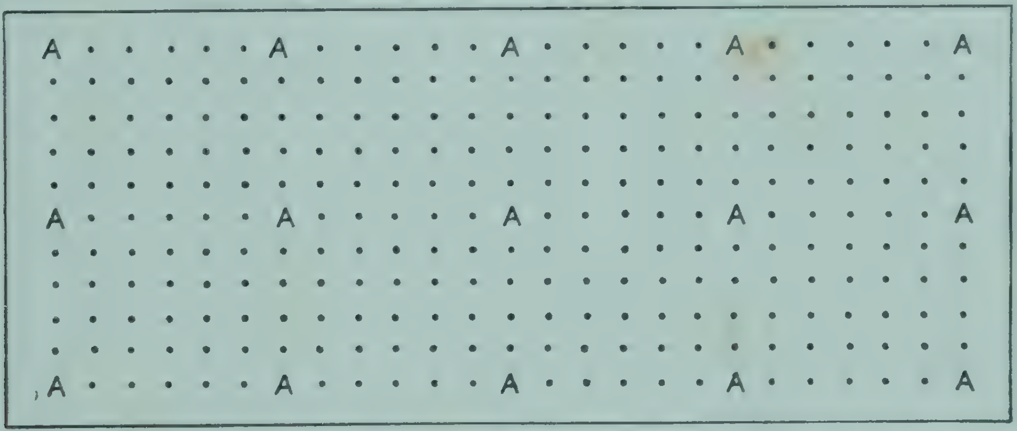


Fig. 331.—Standard Apples 18 ft. apart, with under crop of Rhubarb—134 Apple Trees and 5000 Rhubarb Plants to one acre

Standard Apples and Rhubarb.—The next diagram (fig. 331) represents a market garden in which Standard Apples and Rhubarb constitute the only crops. The Apple trees are planted 18 ft. apart every way, thus giving about 134 trees to the acre. Beneath these about 5000 stools of Rhubarb are planted (although 4000 would give much better results). In this case each Apple tree has 36 sq. yd. of space against the 11 sq. yd. in the bush plantation. It therefore makes a much larger head, and produces, at least, two or three times more fruit. Reckoning only 3 bus. of fruit per tree, there would be a yield of 402 bus. to the acre. At 3*s.* per bushel this represents a gross revenue of £60, 6*s.*

To this must be added, say, £30 for the Rhubarb, making a total of £90, 6*s.* for the two crops, from which, of course, cost of labour, rent, &c., must be deducted as usual.

There are several other ways in which Apple land is under-cropped besides those mentioned, one excellent way being to have the standard trees planted 15 ft. apart every way on the square, and to have three rows of market bush Roses like General Jacqueminot between them.

Overcrowding.—In many old market gardens it is not unusual to see trees so closely crowded together that one wonders how anything like a remunerative crop of fruit can be secured from them. In many cases the fault lies, not with the grower, but with the landlord, who stipulates that a certain number of trees must be planted to the acre, probably under the impression that he can charge a higher rent for land carrying a large number of trees. The fact that air and light are essential to the proper growth and ripening of fruit trees seems to be overlooked altogether, and that when more than, say, 320 bush trees, or more than 160 half-standard trees, are planted to the acre, the value of the holding declines instead of being improved. The numbers mentioned may appear small when the trees are first planted, but at the end of eight or ten years it will be found that they have none too much space at their disposal. A cradle is quite large enough for a baby, but will be woefully

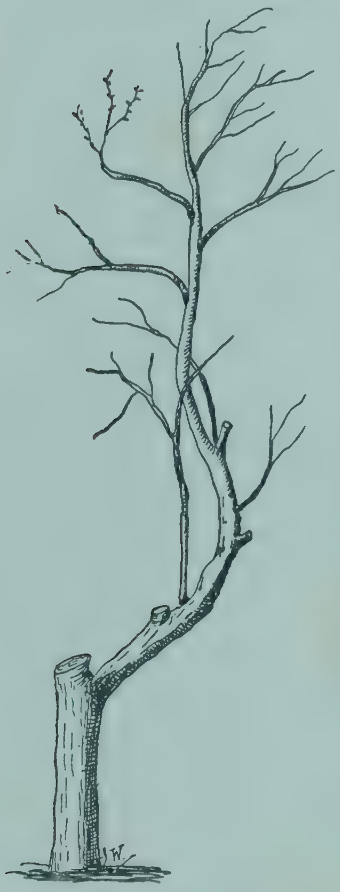


Fig. 332.—Plum Tree not more than fifteen years

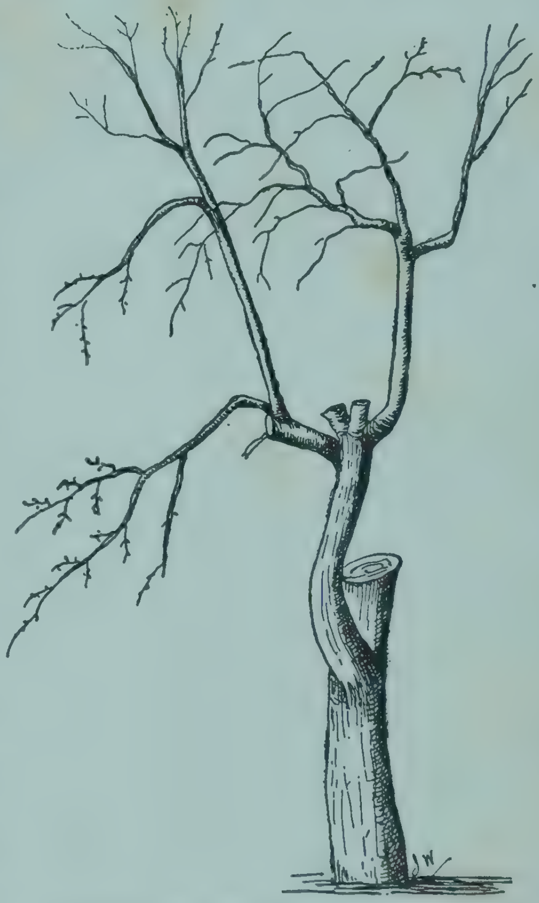


Fig. 333.—Plum Tree about twenty years

lacking in accommodation as the baby grows into manhood. It is the same with fruit trees; space must be allowed for development. The man who takes on a thickly planted garden, under the impression that he will get more fruit from 1000 trees to the acre than he will from 320, simply does not know his business, or the laws that govern plant life, and he is sure to fail. The annexed sketches show what too frequently happens to fruit trees planted too closely together. One (fig. 332) represents a plum tree about fifteen years old; the other (fig. 333) one about twenty years of age, both taken from actual examples. It will be seen that instead of being in the prime of life and capable of yielding good crops, they are in a miserable, decrepit condition, cumbering the ground upon which they stand within about 8 ft. of their neighbours. The main stem has been cut out long ago, and side shoots have struggled up in search of air and light, but even they are already in a mutilated condition.

The following analysis of 1795 trees (mostly Plums with a sprinkling of Apples and Pears) in a market garden will show the evils of overcrowding from a financial point of view. The garden is considered a good one as market gardens go, but it will be seen from the figures that over half the trees are a long way below par, and do not pay their way as they ought.

	Good.	Fair.	Middling.	Poor.	Bad.	Maidens.	Total.
Plot I ...	255	92	76	86	29	5	543
Plot II ...	225	158	39	67	58	17	564
Plot III ...	284	125	56	56	35	12	568
Plot IV ...	—	—	—	120	—	—	120
	764	375	171	329	122	34	1795

If all these 1795 trees on about 4 ac. of ground had been in a proper state of growth each one would have yielded at least 10*s.* worth of fruit annually, making a total of £897, 10*s.* Owing to the wretched condition of most of them, however, the entire crop could be valued at only about £550 in a good season, representing an annual loss to the grower of £347, 10*s.* In other words, he paid the terrific fine of £347, 10*s.* per annum for having overcrowded his garden. At the end of a twenty-one years lease this would represent at least a total loss of about £2000, to say nothing of the cost of labour of cutting out the dead wood in the winter. If 800 trees, instead of 1795, had been properly planted on the same area, the crop of fruit would probably have been worth 15*s.* per tree, giving a total revenue from top fruit alone of £600. With 800 trees, therefore, the grower would have obtained £50 a year more than he did with 1795, and the cultural expenses would have been lighter in proportion. [J. W.]

§ 3. STORING APPLES

The hard and later-ripening varieties of Apples lend themselves well for storing. In many market gardens neither sufficient care nor attention

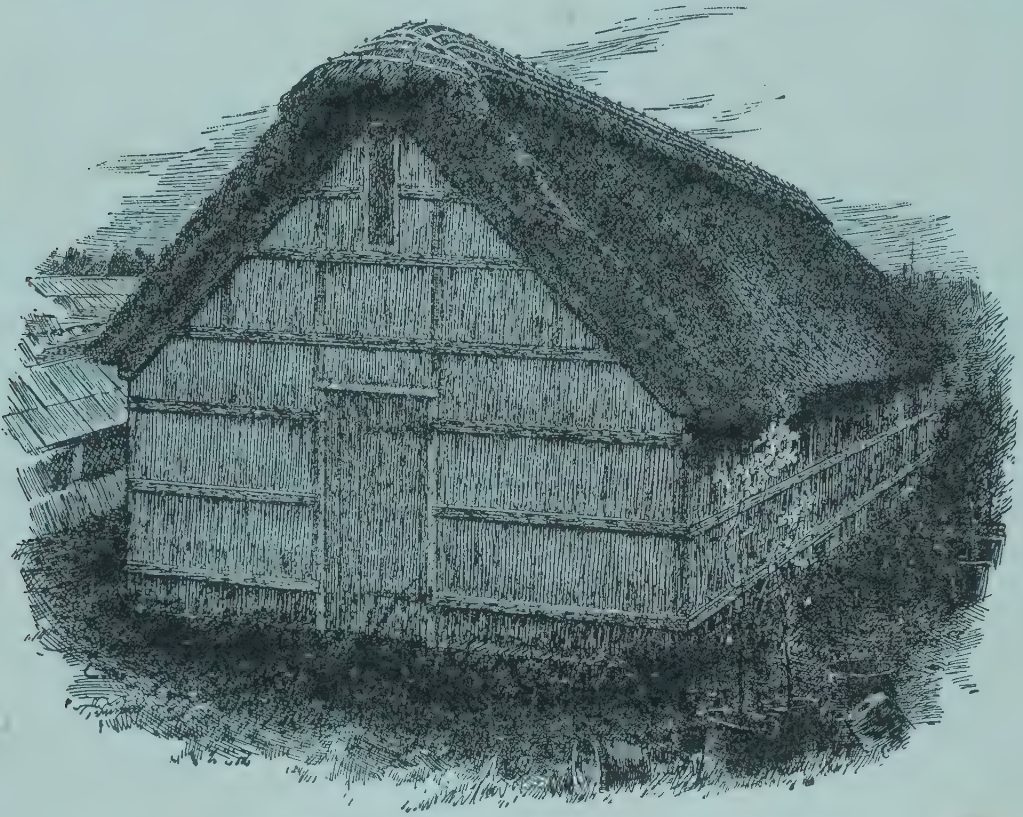


Fig. 334.—Bunyard's Fruit Room (exterior)

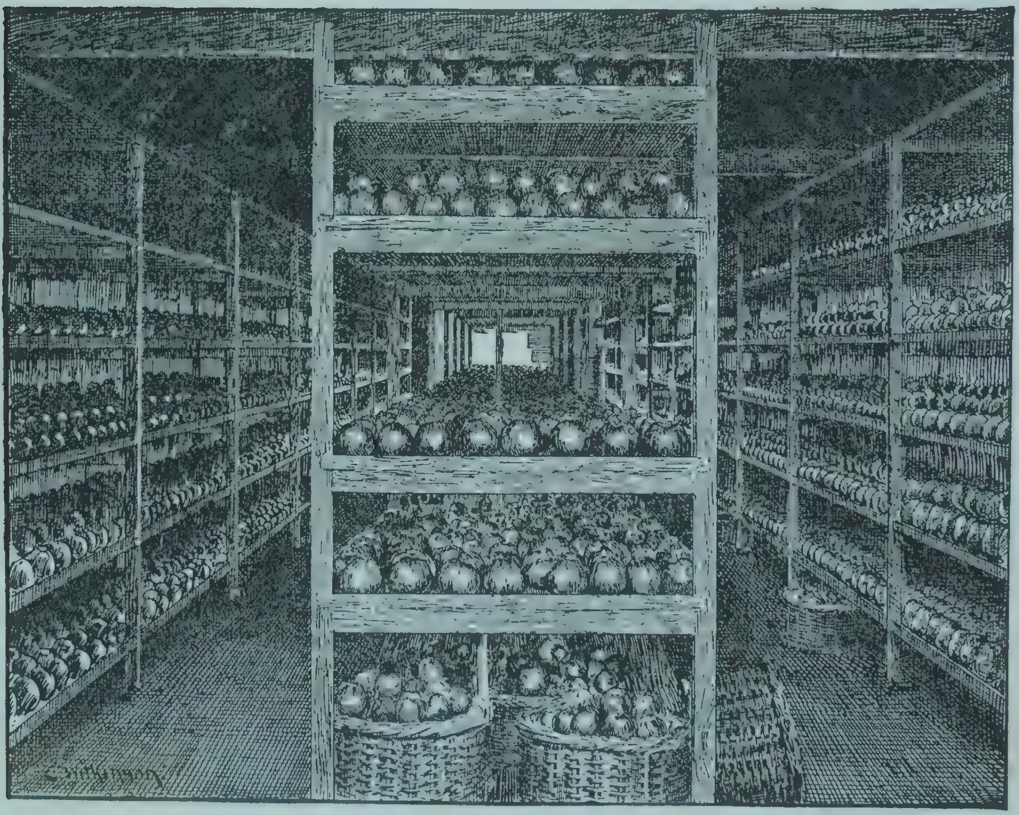


Fig. 335.—Bunyard's Fruit Room (interior)

is given to picking the fruit carefully, and storing it properly; the result is a considerable loss on the crop, when a profit might have been the result.

It has been demonstrated over and over again that British apples, properly cared for, will keep well until the April and May following the season of picking. But this desirable result cannot be achieved by picking the fruit roughly and throwing it in heaps on to a barn or shed floor covered with a slight layer of straw. The bruises caused by rough handling and treatment soon cause decay to set in, and one bad apple will soon infect others if not taken away.

The illustrations show an exterior view (fig. 334) of Bunyard's fruit room, and an interior view of the same (fig. 335). This fruit room is 30 ft. long, 12 ft. wide, and will hold 300 bus. of apples. The cost is about £30, which may be spread over say twenty or thirty years—not an expensive item even considered from a market gardener's point of view. Indeed, many market growers already have fine cool sheds or barns that could be readily converted into a fruit room, and the cost would probably be repaid the first or second season.

From the interior view it will be seen that shelves, 3 to 4 ft. wide, run down each side, and are divided from the central range by a pathway. Wooden battens, about 3 in. wide, are used, and about ½ in. of space is left between them to permit of free circulation of air. The fruits are placed in a single layer on the shelves, and these may be

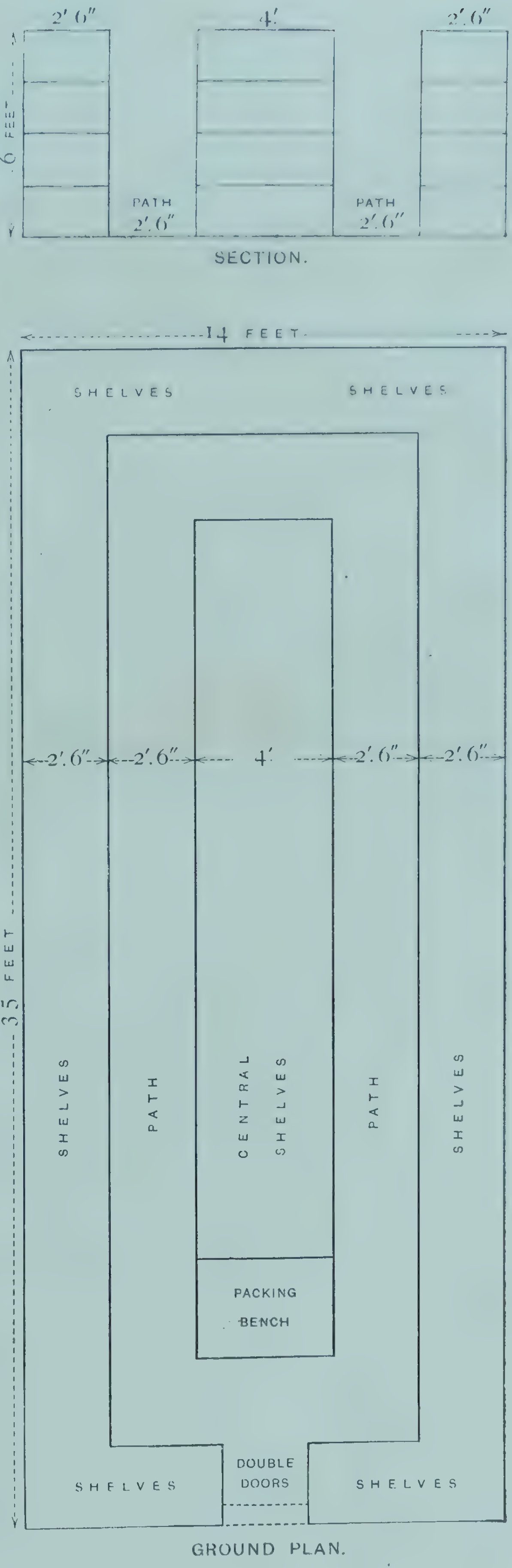


Fig. 336.—Section and Ground Plan of Fruit Room at Foxbury

1 ft. or 18 in. above or below each other, being supported at intervals by strong upright posts and horizontal struts. As may be seen, the fruits are packed into baskets when ready for market. The subjoined plan will give one an idea of the dimensions of the fruit room at Foxbury Gardens, Chiselhurst (fig. 336).

The main point about a fruit room is to build it so as to secure an equable temperature always, from 45° to 50° F. The walls are usually built of matchboarding with a layer of reeds 7 to 8 in. thick outside. The reeds are kept in place by horizontal strips of wood securely nailed to the uprights. The roof is thickly thatched, and a ventilator covered with wire netting is placed at each end at the apex of the gable over the doorway. The floor is generally cemented over, so that too much moisture shall not ascend from the soil.

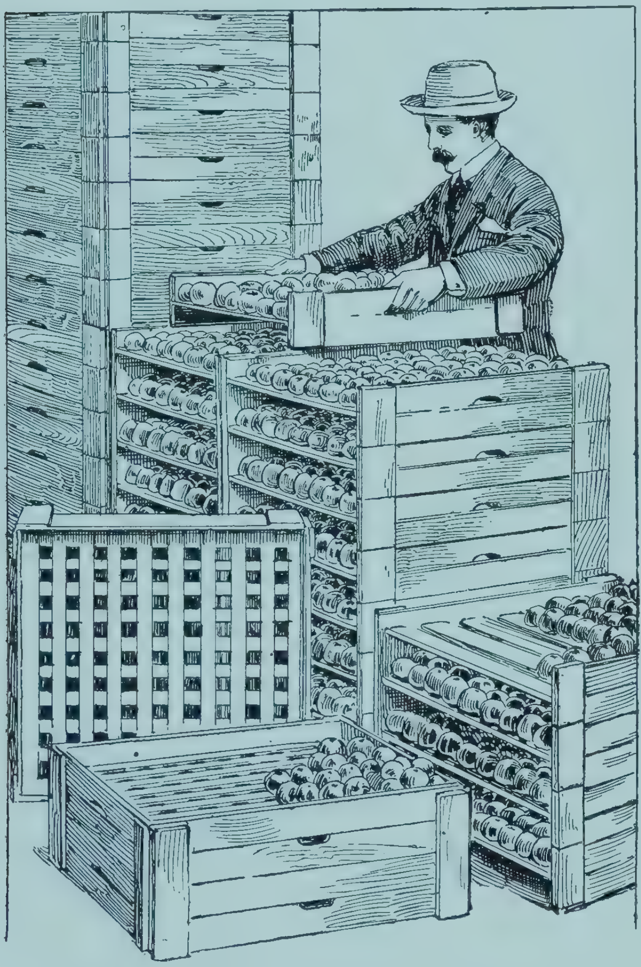


Fig. 337.—Orr's Storing Trays for Apples, &c.

The advantage to the market grower of having a good fruit room available is that at times of glut he can hold over his stock and then place it on the market when better prices are ruling.

Of course the fruit will require examination from time to time, for no matter how carefully it has been picked and handled, some specimens are sure to show signs of decay. These should be removed at the earliest moment.

Where it may be inconvenient to fix up a fruit room proper, trays made of wooden battens might be used with advantage for storing fruit. The illustration (fig. 337) shows how these trays are used, and quite a large quantity of fruit can be stored away in single layers in a comparatively small space, by placing one tray over the other. [J. W.]

§ 4. THE BEST VARIETIES OF APPLES TO PLANT

The varieties enumerated in a nurseryman's catalogue are bewildering in their diversity. When the "doubles" of varieties, which are to all intents and purposes synonymous in character, are eliminated the remainder is a formidable enough array to face.

Very many of them are fancy sorts, only suitable for private culture, or for show purposes, and others are purely local varieties. As a matter of fact, the number of varieties that are worth planting for commerce is not very large, and would be smaller but that in order to obtain the same class of apple on different soils and in different climates, several varieties must be cultivated. A grower, however, must not lose sight of the fact that many keen and able men are year after year patiently applying the wonderful laws of hybridization in the effort to obtain new and improved combinations of characteristics. The same process that evolved a "Cox's Orange Pippin" or a "Lane's Prince Albert" may yet produce better varieties than either, and it is an occasion that calls for the exercise of the highest powers of sound judgment and discriminating foresight when the grower is called upon to decide whether or not to admit a new variety on to his list, and whether to admit it by increasing his range or by discarding an old one.

The difficulty facing one contemplating putting down a plantation in a district where fruit is not already being grown, is that it will take several years to prove what varieties are most suited to it. The general character of the soil and the climate will afford some guide, but the only sure one—experience—cannot be purchased with money. If someone else in the neighbourhood has not made proof of it, the grower must exercise the best judgment he can, and be prepared to remedy mistakes, when discovered, with promptness and with as much philosophy as he can command. When he visits the nurseries to buy his stock he must hold in check the natural propensity to try this, and that, and the other, strongly recommended perhaps by the would-be seller, and confine himself to sorts of proved commercial value. The market is strongly suspicious of new introductions, and it takes time for one of even striking merit to get itself adopted; to be a pioneer is not just the rôle to be recommended for adoption by the starter in the business. On a plantation of 50 ac. ten varieties of culinary Apples and six of dessert will afford an ample range of variety. Under conditions at present obtaining in the apple market it is advisable to confine one's selection to such varieties as can be sent to market straight off the trees, the returns for which can be snugly harvested in the grower's bank by the first week in October. It may be good matter for the padding of a political speech to talk of growing apples on English soil to oust those imported from Canada and elsewhere, which form such a feature in the winter in every fruiterer's shop; but the business man will recognize that thought he home-grown "keeper" is easily first in quality, for appearance and for cheapness there is nothing home-grown to touch the best marks of the importer; and since only one crop of apples can be grown on any given land at once, the grower is wise who selects only varieties that will not come into competition with the imported ones.

At the Kent County Commercial Fruit Show, held in December, 1911, there was got together a remarkable collection of several hundred boxes of apples all packed in standard non-returnable boxes; culinary variety in "bushel" and dessert variety in "½-bushel" boxes. The fruit came mostly from the county of Kent, though other parts of England and Ireland also were represented. The grading, packing, and general appearance were such as to rival the best specimens of transatlantic imports, while the quality was English. The varieties represented in greatest quantity were Bramley's Seedling, Newton Wonder, Lane's Prince Albert, Cox's Orange, King of the Pippins, Gascoygne's Scarlet, while the champion box was composed of Annie Elizabeth. The show, which was largely due to the enterprise of the authorities of Wye College, was an evidence of British pluck; but more than that it points to a new avenue for the home fruit grower, and it shows that the methods which have enabled the exporter to our shores to create a market for his wares here, if adopted by the home grower, will enable him to have his share of it; and may we not add, one more evidence is afforded of the healthy stimulus and public advantage of free competition. [W. G. L.]

§ 5. CULINARY APPLES

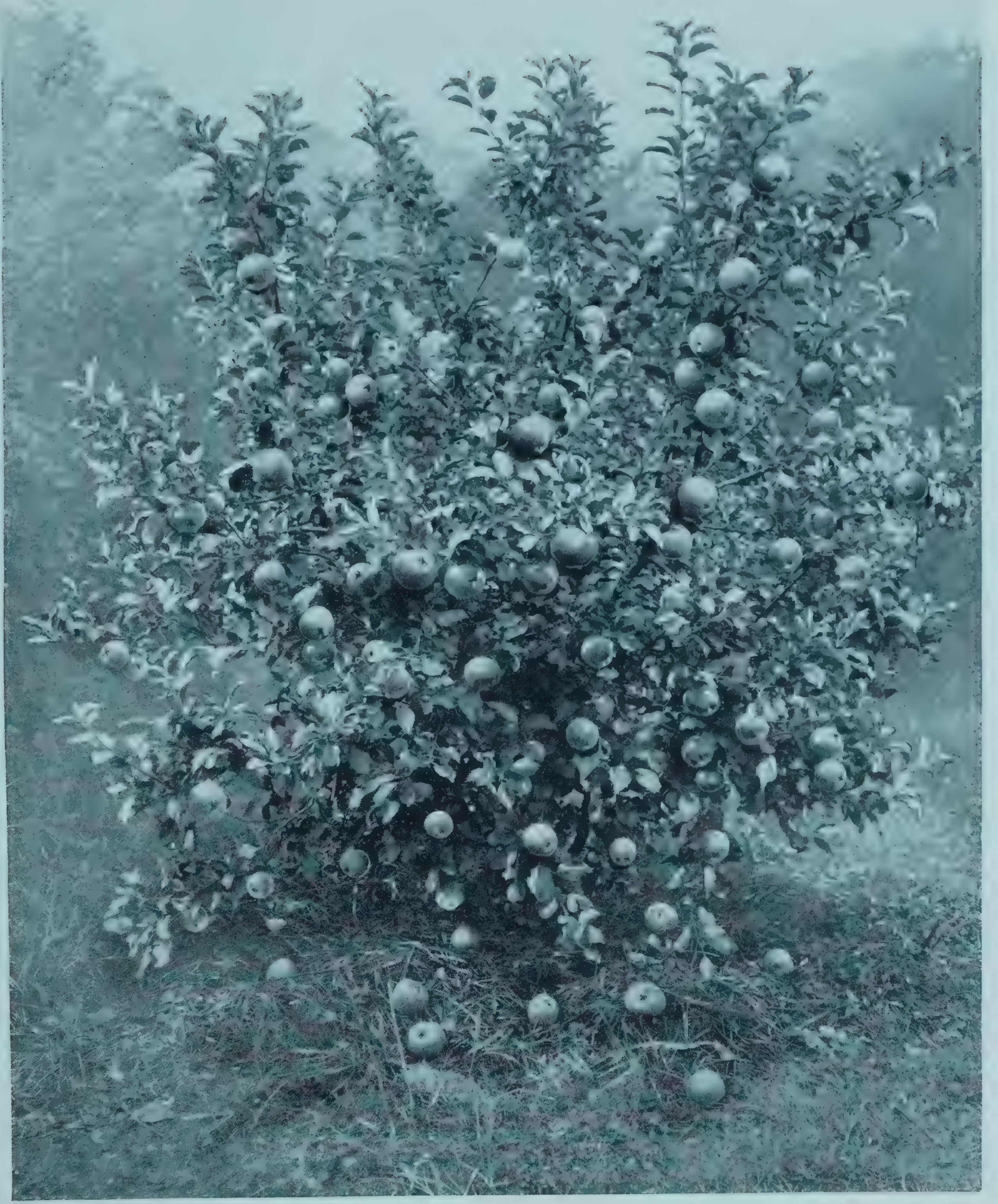
Early Victoria or Emneth Early.—This is the earliest apple to be fit to gather—it was cleared in 1910 before the first of August. The fruit is conical and shapely, with a clear skin and set singly on the branches. It is a most prodigious bearer, and should be grafted upon the Doucin stock in preference to the Paradise, or it will bear too profusely to make a tree. On the Crab it comes quickly into bearing.

Lord Grosvenor.—This is an Apple with a splendid constitution—a bad sort for purveyors of spray fluids, for it can almost look after itself. Its fruit comes in clusters. It is best to commence thinning them as early in July as the apples can be sold, and they may be thinned two or three times before clearing. The fruit often comes of an ugly shape, and it is not a sort that obtains the highest price, but from the vigour of its growth, its readiness to adapt itself to light or heavy soils, and owing to its fertility it should have a place in every plantation.

Lord Suffield.—This is a conical-shaped apple of green skin, ripening yellow, of first-rate quality, always commanding the highest price. It is a free bearer on the Paradise stock. On the Crab it must only be planted on warm stony soil or it will be a failure. In season August and September.

Grenadier.—This is a Codlin of the very best quality. The tree is of compact growth and it bears freely on any stock. If thinned as soon as saleable it will produce very large fruit. This is roundish ovoid, prominently and bluntly ribbed up to crown. The skin is yellowish green. In use in September and October.

Ecklinville Seedling.—Mr. Bunyard says: "This is one of the best early kitchen Apples, and seldom fails to bear a heavy crop". It forms a splendid, shapely tree on the Crab requiring hardly any training. The fruit is soft, easily bruised, very much sought after by birds and flies.



BUSH APPLE TREE, "ECKLINVILLE SEEDLING"

Seven years old. In Messrs. Ambrose & Palmer's Market Garden, Shepperton, Middlesex

It is also liable to scab, and requires the help of the spray machine to defend it against the Apple Sucker. In Herefordshire some wonderful sums of money per acre have been reported as having been netted from this apple. It should be gathered in August. (See Plate.)

Keswick Codlin.—This variety is found in many of the older market gardens, and is valued for its earliness. It often fetches a higher price if picked when only three parts ripe than if allowed to remain too long and get soft and yellowish. It is of medium size, conical, with sharp ridges round the eye. It will probably be superseded by the Early Victoria mentioned above. It is an excellent cooker.

Lady Henniker.—A good cooking Apple but with the reputation of taking a long time to come into bearing. Fruit large, roundish, and bluntly angled, and comes into season in September and October. It is yellowish when ripe, and lasts well.

Stirling Castle.—This is an Apple that makes it its business to crop, and scarcely thinks about anything else. It can be thinned as early as the middle of August. If left to mature, the fruit attains a great size. Some Stirling Castles grown in Middlesex in 1909 were sold at Covent Garden at 6s. per dozen. On the Crab stock it cankers badly in cold soils; on the Paradise it will produce heavy crops of fine apples in a very few years. The name Stirling Castle is a passport to top prices all over the Midlands. No plantation should be without this sort.

Lord Derby.—This is a valuable green cooking apple of comely shape. It has the advantage to the fruiterer of being one of the heaviest apples grown. It is a sturdy grower and a good cropper. It will follow the varieties named above.

Lane's Prince Albert (fig. 338).—This is one of the best Apples ever introduced; there is scarcely a desirable quality it does not possess. The growth of the tree is vigorous without being too spreading, the branches become profusely covered with bloom buds, and it does not blossom too freely to prevent its cropping. The fruit comes clean and even-sized, not too large, yet with few small ones. It will cook well in September or keep till March. It possesses all the cooking qualities of the Wellington, and is four times a more reliable cropper. It does well on either Crab or Paradise stock; and though it prefers warm soils, it will accommodate itself to a strong soil if not too wet and cold.

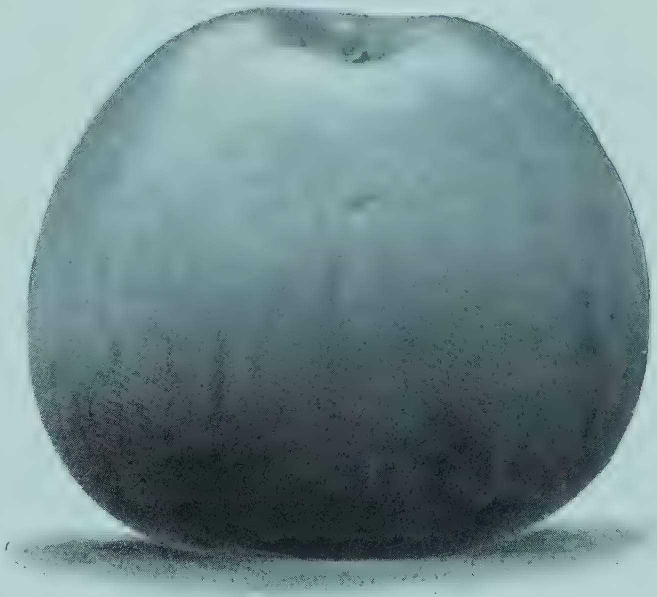


Fig. 338.—Apple. Lane's Prince Albert. (½.)

It is especially valuable for grafting on already established trees, where it quickly makes a head and comes into bearing. (See Plate.)

Bramley's Seedling.—Introduced about 1883 this Apple is becoming very extensively planted. It has many of the qualities that go to make a first-class culinary apple, though its flavour cannot be said to be above the ordinary. A very free grower, it takes a good time to come into bearing, on orchard standards or half-standards fully ten years, while on the Paradise stock it will not bear if closely pruned. This may account for the hesitancy there was about it until quite recently. The close pruners condemned it as a "no cropper", and it was not until someone had "let it go" long enough to enable it to reveal its true character that there was any confidence in it. Nevertheless it is an Apple that is safer to plant on poor clays and light soils than in fertile spots where its free growing disposition will lead it to dissipation. The fruit is in season up to January.

Bismarck.—A very fine apple in some places but poor in others. The fruit is large and even, yellow, flushed and striped with red. Cooking qualities good. Season, December to April.

Warner's King.—No list of culinary Apples will perhaps be considered complete without this Apple, though of all the sorts mentioned here it is the least to be recommended.

Mr. Bunyard says it is the largest apple grown, and has scaled 32 oz. in Kent. It makes a very spreading tree on the Crab, and wants more room than the crop it bears deserves. It will canker in cold soils. On the Paradise it does better and crops more freely. It can be gathered at the end of September, or will keep all the winter; and it has been known to keep until apples had come in again.

Pott's Seedling.—This Apple is a horticultural analogy to a man with a big intellect set on a sickly body. As a fruit it is admirable —solid, shapely, of good size and quality.

The tree when first planted gives every promise of a fruitful existence. The joints are short, the branches thick and sturdy, the fruit buds full and prominent, and the foliage luxuriant, but after a year or two it loses vigour, becomes a prey to every pest there is about, and cankers away. It is only mentioned here in order to suggest it as a good variety to plant if it is decided to plant cordons between the bush or half-standard trees until these grow big enough to take all the ground. It will crop vigorously in this form for a few years, when it can be done away with. In season September and October.

Gascoygne's Scarlet.—Although, as a rule, red cooking apples are not favourites with the buyers, this is the exception to the rule.

It is one of the handsomest apples grown, coming to a dark-red colour. The tree is spreading and requires room. It is of good constitution, and a free and first-class bearer, the fruit being set evenly over the branches. No one need be afraid of planting it. In season December and January.

Golden Spire.—Although this cannot yet be said to be a market apple, it cannot be long before it becomes one. On the Paradise stock it is a most profuse bearer, its fruit is of a conical shape with clear skin, and its quality is good. The plate shows a tree that has been planted two years, that is, four years from the graft. In season November and December.

Newton Wonder.—In season November to May. This Apple is gradually winning its way into the newer market gardens, and is likely to maintain its hold. It is a useful late variety, of excellent constitution. Tree of vigorous growth as a large bush or standard on the Crab; satisfactory as a bush on a dwarfing stock. Fruit large to very large, round, even, yellow and crimson when ripe, firm with a brisk acidity and good flavour. The trees must not be severely pruned.

Dumelow's Seedling.—Still better known as "Wellington". One of the very best cooking apples in use from November to March. Very heavy cropper. When given plenty of space, say 25 to 30 ft. apart, well-established trees will bear an average crop of 15 to 17 bus. per annum.

Annie Elizabeth.—A fine cooking apple highly esteemed in the Midlands. In season from December to April. Fruit large, round and ribbed, yellowish tinged with red.

§ 6. DESSERT APPLES

The case of the dessert apples is quite different from that of the culinary varieties just considered. Most culinary apples in highest favour with the public are green in colour. For some reason or other a red culinary apple does not sell so readily as a green one does. The chief desiderata for a cooking apple are large size, good cooking, and firm enough substance to stand travelling without showing too many bruises. A clear skin, of course, is a desirable condition in any fruit; but manifestly surface blotches in apples, the largest proportion of which is going to be peeled in the cook's laboratory before coming to table, do not so clearly and certainly condemn them as the slightest blemish does the dessert apple, which has to present itself as a thing of beauty, and add its charms of form and colour to the table decorations before becoming a willing victim to the silver knife. It follows, therefore, that with dessert apples different conditions apply. Large size is not a desideratum here. No one desires at dessert to have a huge apple put upon his plate. Form, colour, maturity, flavour, and medium size are the things desired in a dessert apple.

It is therefore easier to find land that will produce tolerable culinary apples than it is to find that in which it is worth while to plant dessert varieties.

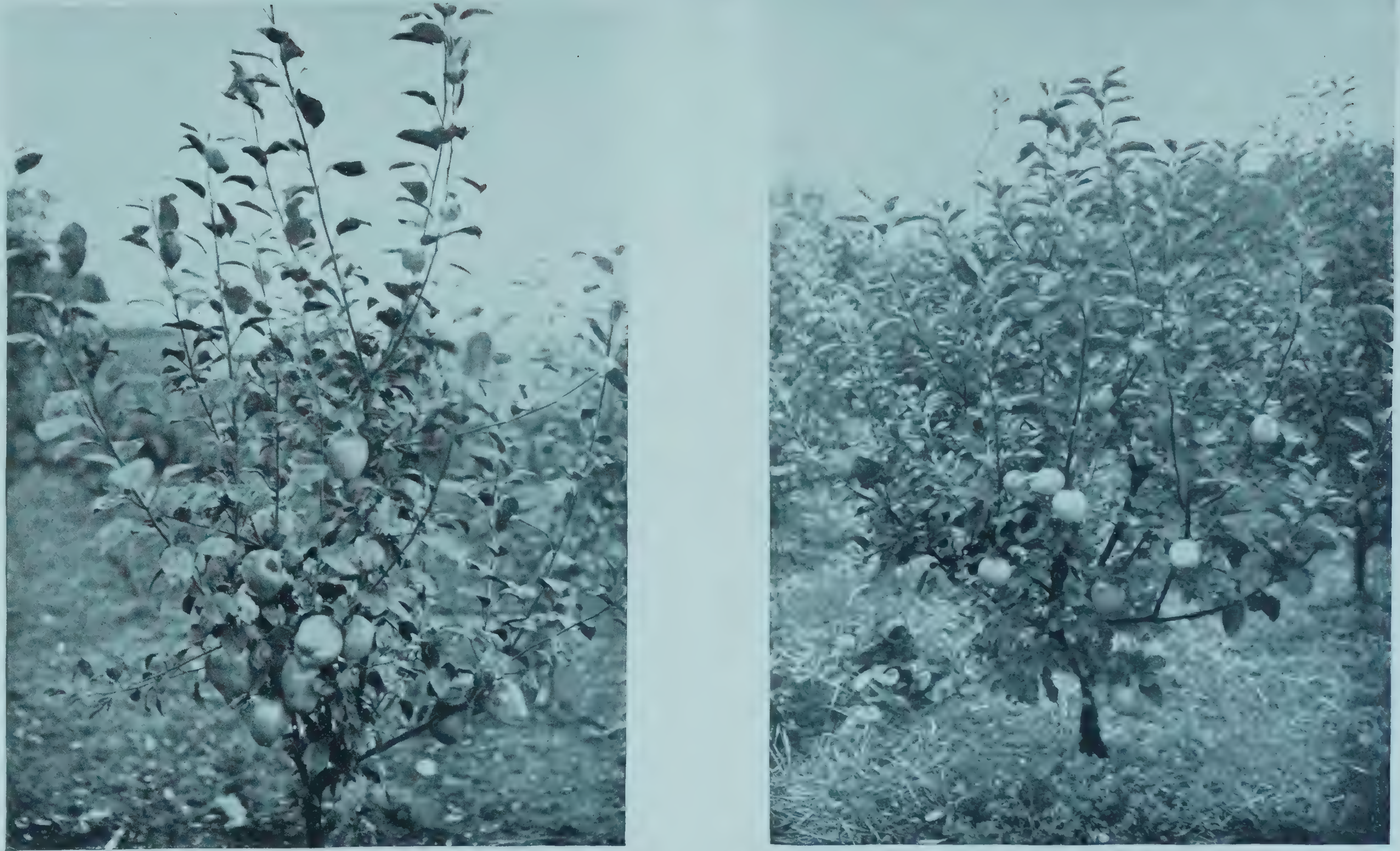
Strong land with clayey or loamy subsoil will grow dessert apples too big and without sufficient colour. Of the varieties described below, the first six are those which can best lay claim to the designation of "market varieties"; the others are too close in the running to be left without notice. They are not put in order of merit, but in the order in which they mature for gathering.

Mr. Gladstone.—This Apple is included by Mr. Bunyard in his list of 100 best Apples. On the Crab stock it forms a spreading tree with vigorous growth. The fruit is of medium size; the colour, when ripe, splashes of dark red laid over streaks of a lighter colour; the flesh is soft and juicy, and the flavour brisk and spicy. It does well on the Paradise. On light warm soil it is a good bearer and colours well. On strong land it is a shy bearer, and does not colour quickly enough to escape birds and wasps, which are marvellously fond of it. Its season is the last week of July or the first of August.

The Devonshire Quarrenden.—This is the Apple which market people will persist in calling "Quarantine". It also is included in Mr. Bunyard's list. Almost everyone knows this apple, with its dark claret colour, solid flesh, and pleasantly acid flavour. The tree will grow in most soils, and the apple will colour well, but he who would grow it with satisfaction to himself should choose for it a sheltered situation and a light warm soil. It makes a big tree, bears to a great age, and does not repay working on the Paradise. The season for the marketman to gather it is the first or second week in August.

Lady Sudeley.—This is another variety bearing Mr. Bunyard's badge of respectability, indeed he calls it "the finest autumnal apple for dessert". It should be grown on the Paradise, on which stock it is a fairly good bearer. The fruit is very handsome, yellow ground with red streaks; the flesh is soft and tender; and the flavour, to quote Mr. Bunyard, "unusually vinous and aromatic". This is an apple that will test whether or no the gatherer knew his work. The way *not* to gather an apple is to nip it with the thumb and first two fingers, because thereby on apples of a soft flesh the thumb and fingers make prints plain enough for criminal identification. The way to gather an apple is to grasp it gently in the *palm* of the hand and give it a slight twist, when it will leave the bough easily, carry its stalk with it, and bear no grudge against the picker. The season for this apple is the third or fourth week of August.

Worcester Pearmain.—This valuable market apple is degraded to the culinary class by Mr. Wise; Mr. Bunyard, however, gives it a seat in the upper house. It is said that the name "Pearmain" is a contraction of *Pyrus magnus*, and has come to be applied to all pear-shaped apples. This variety is admirably suited for planting where it is desired to have alternate rows of Apples and Plums, because its compact upright habit will allow of both rows having plenty of room if the Plum is of the moderate habit of the Victoria. No other dessert apple possesses so many of the characteristics desirable in a market apple. It will crop and colour in almost any soil, it will stand gathering before it is ripe, stand a long journey, and come to maturity off the tree. Everybody knows it, and



"GOLDEN SPIRE"

"JAMES GRIEVE"

BUSH APPLE TREES

all who know it ask for it. No plantation of fruit should be without it. Its season is the beginning of September for first gathering and mid-September for clearing.

Cox's Orange Pippin.—Here is the monarch of all English Apples. It is recorded of the late Mr. Thos. Rivers, that once at a fruit show he was asked by a distinguished statesman to name the twelve best Apples. "Well," said Mr. Rivers, "for the first three I should plant Cox's Orange. "And for the next three?" "Well, for the next three I should plant three more Cox's Orange." "And for the next three?" "I should plant three more Cox's Orange." "And for the last three?" A little hesitation, then, "Why, I should plant another three Cox's."

It is doubtful whether there is any other fruit, not excepting the lordly Pineapple, that can compare in deliciousness of flavour with a well-grown, properly ripened English Cox's Orange. But, alas! the range of soils in which it will dispense its favours freely is very limited, and the commonest cooker that will crop is more valuable to the market grower than the Cox's Orange that will not. It is of no use planting it in strong loamy soils, even on the Paradise. In such it will grow vigorously, but of apples there will be a crop about once in ten years, and then the apples will have rough skins and be wanting in colour. On the other hand, it will crop freely in gravel soils where hardly any other fruit tree will live, and in such or any warm soil will bring fruit of splendid colour. From some hot gravelly soil in Essex, in 1909, Cox's Orange Pippins were sold at 3s. *6d.* per dozen off bush trees on the Paradise, only planted two years, and there was a heavy crop of them. This apple pays for keeping a few weeks after gathering. The fruit should be looked over twice or thrice a week, and those that ripen should be picked out for packing, and also any that show signs of "speck". The time for gathering is Michaelmas. (See the plate.)

King of the Pippins.—This is a favourite old apple. It should be gathered about Michaelmas, and may be fit to send to market a little before Cox's Orange. It will not pay for the sorting and selecting that is done in the case of the Cox's. It will crop heavily, and, if kept a little, will come to colour even in cold soils, although it is liable to canker. It is a sure bearer on the Paradise. Mr. Bunyard says in Kent it is the practice to prune this sort heavily and feed liberally, and that for this treatment it pays.

James Grieve.—This is a Scotch Apple of quite recent introduction, and well worth the market grower's attention. On the Paradise the tree is healthy and vigorous, showing no inclination to canker. It came into bearing the first year after planting, and so far has not missed in the experimental plantation from which the photograph was taken (see Plate). That Mr. Bunyard describes it as an early Cox's Orange is sufficient certificate of quality. On strong land the fruit is apt to come rather large for the table, but this is a fault that may be remedied as the tree gathers age. Its season for ripening is late September.

Irish Peach (fig. 339).—Many would consider a list of the market varieties of the table apples incomplete without this one. It is an old variety, ripening in August. It makes a good tree on the half-standard, and, when established, bears well, but does not come into bearing quickly. Its fault is a liability to drop without any notice just before it is decided to gather it.

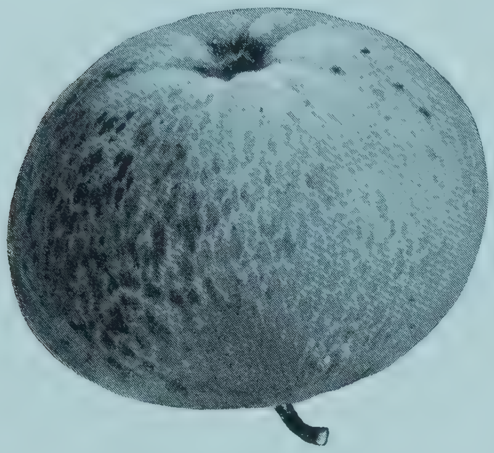


Fig. 339.—Apple. Irish Peach. (½.)

Duchess Favourite.—This is an apple much grown in Middlesex. It is a medium-sized fruit, of bright-red colour and pleasant flavour. The tree is a sure bearer after it is twenty years old. The fruit will not colour if gathered before ripening; as soon as it is coloured it drops. The practice is to mulch the soil beneath the trees with litter and let the fruit drop; this, however, will not do where Gooseberries are planted as the under crop.

Ribston Pippin.—This old favourite still finds a place in some market gardens on the Paradise stock, on which it crops fairly well on warm lands, and keeps fairly free from canker. Its position has been quite usurped by the Cox's Orange Pippin.

Beauty of Bath.—This little early Apple has been much boomed by some tree raisers, and in consequence it has been planted by some market growers. It is much to be doubted whether any of them will give it a good character. If it would only bear enough fruit, its earliness, attractive appearance, and most acceptable flavour would make it a favourite.

Golden Reinette.—This is a valuable Apple for cold heavy soils where hardly any other Apple will do. It is an "every other yearer". On the Crab as a half-standard it makes a magnificent spreading healthy tree, free from canker, and appears to be able to take care of itself against any pest. It requires plenty of space. Its fruit ripens in November, and will come to maturity after being gathered. It is something like the "King of the Pippins" in appearance and flavour. After the first year or two the tree needs little pruning. [W. G. L.]

Early Julyan.—An early Apple found in many Middlesex market gardens. It ripens at the end of July and early in August, the fruit being of medium size, prominently ribbed from the eye to the base, and pale yellowish in colour when ripe. Good for dessert or cooking. It crops heavily, and is best as a bush.

Blenheim (Orange) Pippin.—When established, this fine cooking and table apple may be relied on for cropping, and if afforded plenty of space, established trees will yield anything from 4 to 20 bus. of fruit. This is large, roundish, and regular in shape, yellow and streaked with red, and of excellent flavour. Selected fruits fetch high prices. Season, November to February.

Allington Pippin.—A fine variety of the Cox's Orange Pippin breed, in season from November to February. The fruit varies from medium to large, roundish conical in shape, yellowish streaked with red. It is a heavy cropper on good soil, the only argument against it being that it is apt to become too large for a dessert fruit.

§ 7. INSECT PESTS

A considerable part of the expenses incurred in the maintenance of the plantation will be those incident to the combating of insect and fungoid pests. Judging by the number of specifics that have quite recently come upon the market, and the prodigality with which money is spent on advertising them, one is driven to the conclusion, either that nature has all of a sudden adopted many new inventions in the pest line, or that some keen commercial men have discovered in fruit growers a source of income ripe for tapping, One can find many growers, hale and hearty, who say that in their younger days spraying and spray fluids were all unknown, and, blissfully ignorant of such worries, and their bill files unburdened by their charges, they obtained better crops of fruit than we do now. It may be so; one knows that it is the multiplication of hosts that gives opportunity to an epidemic, and perhaps it is the great increase in the number of fruit trees in cultivation which has given opportunity for such a multiplication of the various organisms, fungoid and insect, that live upon them, as to make it a matter of necessity for the grower of to-day to call in the aid of the chemist and engineer to put into his hands weapons with which to check their ravages. There is this to be said, that in the indiscriminate slaughter of all things living on the trees with toxic sprays, the innocent suffer with the guilty, and nature's own antidote to what is a pest to the fruit grower is swept along with the pest into a common grave.

If it be true, and there is no doubt it is, that a modern fruit plantation is not fully equipped without spray machines and the materials for spraying, it is also true that judgment is needed in the use of them or much money may be thrown away. A spray should be looked upon as a remedy for a certain disease, only to be used when that disease appears. Some people talk as though spraying should be done after the manner of the man who on leaving home on Monday whipped his children all round because they would be sure to deserve it before he came home again! The pests, insect and fungoid, that affect fruit trees form a horrible list as set out by the entomologist and the mycologist, but so do the diseases that human nature is subject to when one is silly enough to read a doctor's book. As a matter of fact those that are responsible for serious injury are few in number in both cases. (See Vol. I., p. 170 *et seq.*).

Dealing with Apples first, the principal are: (*a*) The Canker Fungus; (*b*) The Apple Sucker; (*c*) The Codlin Moth; (*d*) The Maggots of the Winter and March Moths; (*e*) The Woolly Aphis or American Blight; (*f*) The Scab Fungus.

Winter Moth (*Cheimatobia brumata*).—This moth, in its caterpillar state (fig. 340), attacks the foliage and even fruit not only of apple, but also of such other fruit as pear, plum, currant, gooseberry, nuts, and raspberry. The Winter Moth is also found in hedgerows and in woods and forests, on Oak, Elm, Birch, Hawthorn, and Hazel. It is widely distributed over Britain, and does much harm. This insect belongs to a family known as Geometrinæ, and the caterpillars are often spoken of as Measurers, Loopers, or Canker Worms.

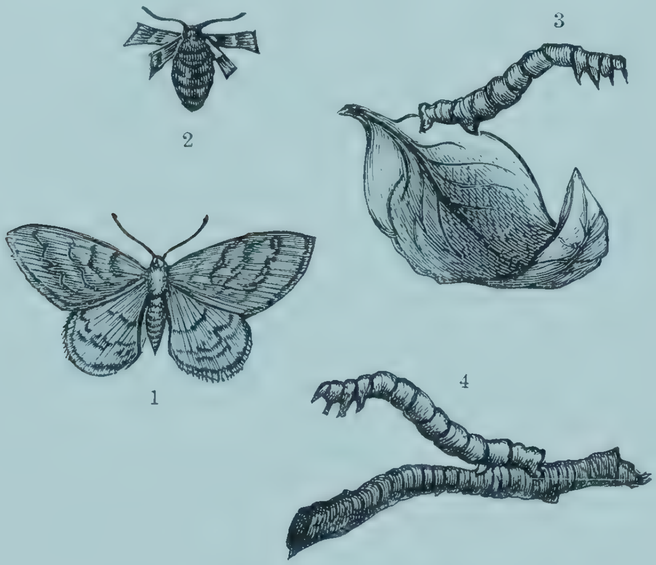


Fig. 340.—Winter Moth (*Cheimatobia brumata*)

1, Male moth. 2, Female. 3, 4, Caterpillar (natural size).

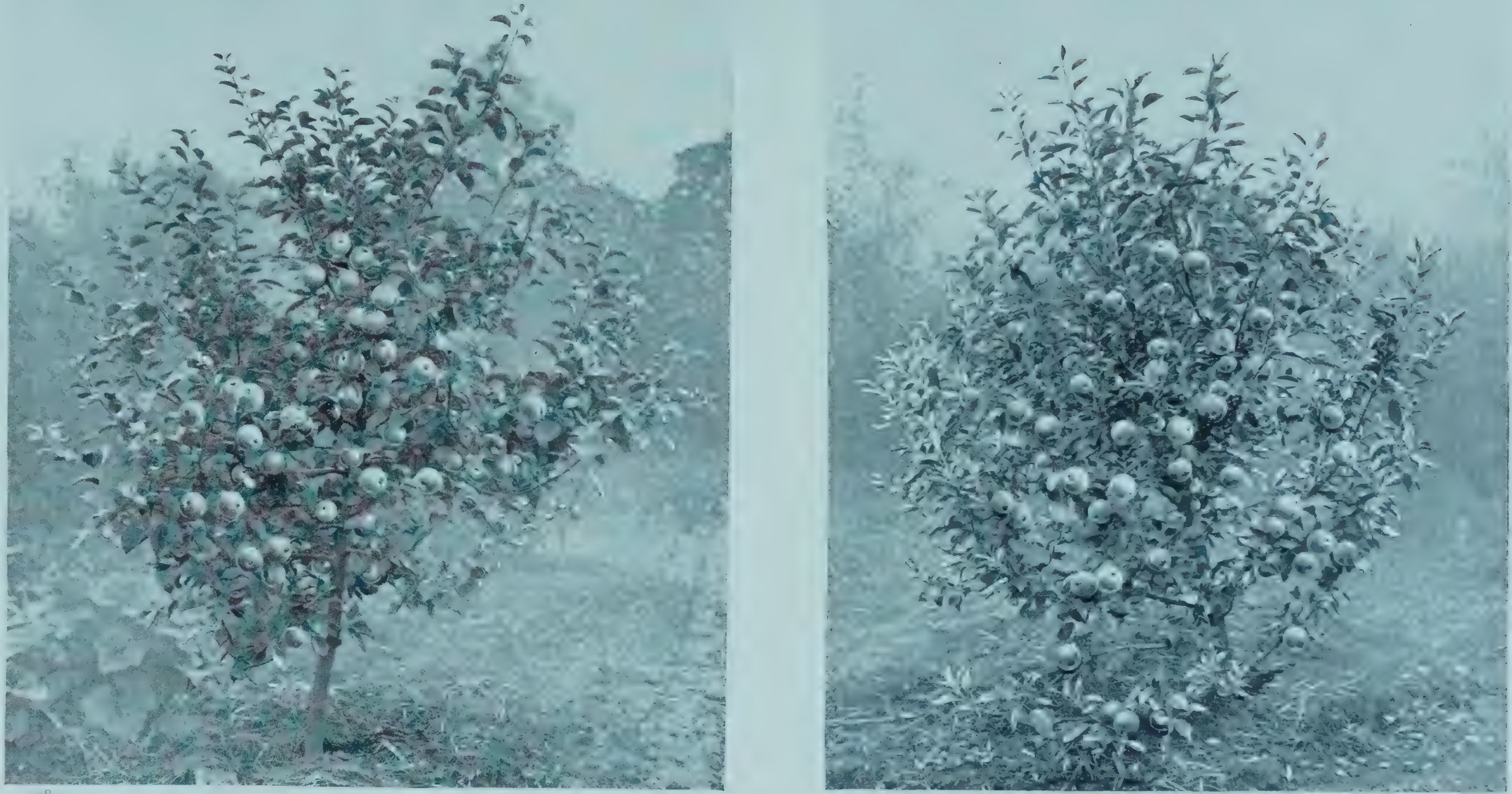
The male moth is winged, the front pair being brownish grey, with darker wavy transverse lines, and the hind pair uniform grey; the wing expanse is about $1\frac{1}{4}$ in. The female is almost wingless, the four organs of flight being reduced to mere stumps, and thus the female is unable to fly.

This moth may appear any time between the first week in October and the second week in January. Both male and female come out of the ground. The males fly about in the orchards, gardens, and hedgerows; the females crawl up the trees to deposit their eggs. One female may lay 200 eggs. The eggs are at first green, but later become brick-dust red; the shell has a delicate sculpturing over it, and is thick. The females lay their ova on the wood or at the base of a bud, on a pruned surface, or even on stakes and rags by which young trees are supported, and also sometimes on the trunk.

The eggs hatch in March, and the small, dark caterpillars at once feed on the buds as they open. Later, they become green, with pale lines, and can be told by having three pairs of jointed legs in front, and only one pair of fleshy feet in the middle, and an anal pair. They mature in June, and then reach over 1 in. in length. The food is not only the foliage, for they also get into the blossom trusses, and spin them together and devour the strigs (pedicels) and blossom.

When mature they fall to the ground and enter it, then spin oval cases of silk covered outside with earth, in which they change to dark-brown pupæ. These earthen cocoons are found from 1 to 3 in. deep in the soil.

Prevention and Treatment.—The female moths may be caught by grease-banding. This is done by first tying a piece of grease-proof paper around the stem of the tree, and then smearing it with some sticky sub-



"LANE'S PRINCE ALBERT"

"COX'S ORANGE PIPPIN"

BUSH APPLE TREES (SEVEN YEARS OLD)

Both in Messrs. Ambrose & Palmer's Market Garden, Shepperton, Middlesex

stance to catch the insects. The bands are best placed 4 ft. from the ground when possible, but at 2 ft. great numbers are caught. These bands should be in working order by the first week in October, and as other moths appear later than the Winter Moth (March Moth), should be kept sticky until mid-April. Tanglefoot is the most lasting preparation for this purpose, and may be put on old trees direct, as it is not a grease. Where banding has not or cannot be carried out, the trees should be sprayed with arsenate of lead, first soon after the buds have burst, and again after the blossom has fallen (see "Insecticides", Vol. I, p. 211, *et seq.*). Poultry are good in an orchard, as they eat the larvæ as they fall; so do pigs. [F. V. T.]

Other Moths with Wingless Females.—Several other moths have wingless females, and may be prevented in the same way. The more important are: 1. The Mottled Umber Moth (*Hybernia defoliaria*), which is larger than the Winter Moth, and the female quite wingless; its caterpillar, a looper, is chestnut brown above, yellow at the sides, and is common where Oaks surround fruit plantations (fig. 341). 2. The Early Moth (*Hybernia rupicapraria*) is common on plums, the larva being rusty coloured. 3. The March Moth (*Anisopteryx æscularia*), which appears in March and early April. The female is quite wingless, and has a tuft of brown hairs at the tail; she lays her eggs in irregular bands on the year's growth of wood, and the ova are covered with the caudal hairs. The caterpillars are green, and are thinner than those of the Winter Moth, and feed mainly on plum, but also on other fruit and Hawthorn. Arsenical spray will destroy all these larvæ, but prevention by grease-banding is best. [F. V. T.]

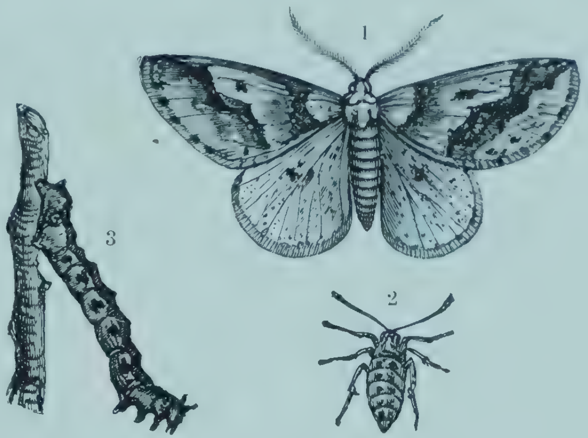


Fig. 341.—Mottled Umber Moth (*Hybernia defoliaria*)

1, Male moth. 2, Female moth. 3, Caterpillar (natural size)

The Maggots of the Winter and March Moths.—These insects, especially the former, have been the cause of much devastation in fruit plantations. A year or two ago some fruit plantations in Middlesex could be seen in which the Apple trees in June were as denuded of foliage by these insects as they were by nature in the winter. It is to catch the moths of these insects that the grease bands, now such a familiar sight round the trees in fruit plantations in the autumn and winter are put. The female moth, being wingless, climbs up the trunk of the tree in autumn, after emerging from the chrysalis stage, in order to lay her eggs on the twigs, so

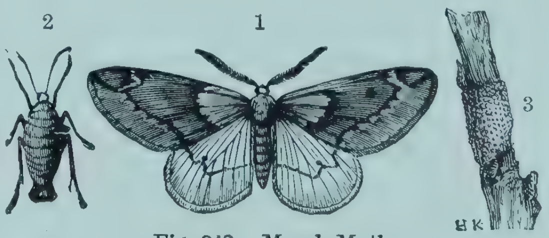


Fig. 342.—March Moth

1, Winged male. 2, Wingless female. 3, Band of eggs.

that the little black progeny may have food close at hand in spring; she is thus caught in the grease, and her maternal intention frustrated. Spraying in the spring with a tonic spray is also recommended as part of the armoury against this pest (fig. 342). [W. G. L.]

The Brown-tail Moth (*Euproctis chrysorrhœa*).—Common now and again in Britain, then suddenly disappears. It is a satiny-white moth, with a dusky spot on each hind wing about 1 to 1¼ in. across the wings. The white abdomen in both sexes has a deep golden-brown tail, which in the female forms a dense pad.

The moths appear in August, lay their ova in a long mass on the leaves, covered with the brown tail hairs. The ova hatch in autumn, and the young larvæ form a small tent of grey silk, in which they remain all the winter, the tent being attached to a shoot or branch. In spring and summer the tents are enlarged, and in July and August the caterpillars spread out and spin their cocoons amongst the foliage, &c. The caterpillars are hairy, brown, with two red spots on the backs of segments 11 and 12 (which can be protruded), and a double red median line and white lateral spots.

This pest is notifiable to the Board of Agriculture. It does much damage in America, into which country it has been introduced.

Treatment.—Winter tents should be burnt. Spraying with arsenate of lead will soon destroy the larvæ.

Lackey Moth (*Clisiocampa neustria*).—Large tents of silk are frequently seen on Apple and Pear trees, on Hawthorn hedges, &c., often 1 ft. in length. These are the houses of the Lackey Moth caterpillars (fig. 343), which now and then occur in such plenty that they defoliate the trees over large areas. The caterpillars hatch in April from regular egg bands laid in the previous year on that year's growth of wood. When full grown they reach 1½ in. in length, and are brilliantly coloured, having thin lines of orange and white, and broader lines of blue and brown, with tawny hairs. They mainly feed under the silken tents, but before they mature they spread out over the trees, and feed ravenously. Pupation takes place in a cocoon of pale silk with yellow powder amongst it, either between leaves or on the branches or fences, &c., near at hand. The rusty-brown moths hatch out in August, and vary from 1 to 1½ in. across the wings, their bodies being very hairy and thick.

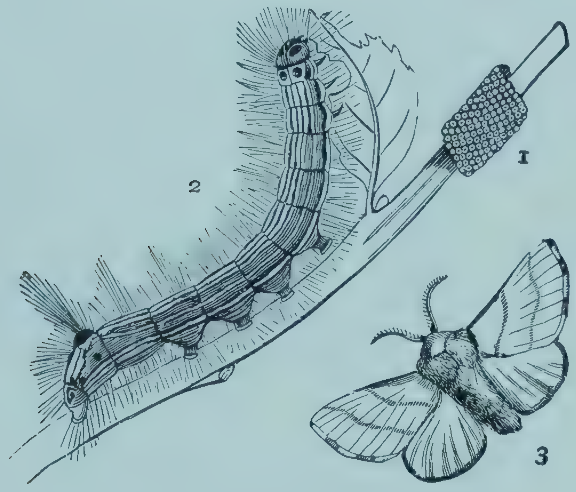


Fig. 343.—Lackey Moth (*Clisiocampa neustria*)
1, Eggs. 2, Catterpillar. 3, Moth.

Treatment and Prevention.—All egg bands should be collected in winter and burnt. The nests may be cut off with long-handled shears and destroyed, and arsenate of lead spraying will kill the larvæ when free.

The Codlin Moth (*Carpocapsa pomonella*).—The so-called Codlin

Maggot is the larva of the moth known as *Carpocapsa pomonella*. It often causes endless damage in Apple orchards all over the world, but seems to be now on the decline in Britain. The moth appears in June and July. In wing expanse it measures about ¾ in.; the fore wings are grey, with darker transverse wavy lines, and a bright metallic spot at the anal corner; the hind wings are uniformly grey. The female lays her eggs on the side of the fruitlets. The ova are small flat bodies with reticulate shell, and are very transparent. They are seen with difficulty. The small larva coming from the egg crawls up the side of the fruit and gets into the eye, where it feeds for a short time, and then it enters the apple, making its way to the core, which it enters, and destroys the pips. It then makes an opening to the outside, and eventually escapes from the damaged fruit. The larva, or so-called maggot, is creamy grey to dusky pink, and reaches about ¾ in. in length. It has six jointed legs in front, four pairs of prolegs, and an anal pair. It can thus easily be told from the Apple Sawfly larva. When it leaves the apple and falls to the ground it soon reascends the tree, and upon coming to any shelter, such as rough bark, moss or lichen, sacking or string, it at once spins a cocoon, and remains in this as a larva until the spring, when it changes to a brown pupa, from which the moth emerges soon after the blossom has fallen. Now and again the larvæ pupate at once, and a second brood of moths appear in August. The larvæ of this second brood pass the winter in exactly similar manner.

PREVENTION AND TREATMENT.—Banding trees with manure sacking, so as to catch the ascending maggots, is an excellent plan. The sacking should be placed close to the ground and double folded. These traps should be taken off in the winter and burnt. Spraying with arsenate of lead within ten days after the blossom has fallen will also do good, as it poisons the small larva before it enters the apple by its eating the arsenic lodged in the eye or calyx cup.

Pith Moths (*Blastodacna vinolentella* and *B. hellerella*).—Small dull-red caterpillars are often found in the centre of the stalk of the trusses of Apple blossom, and even in the leaf spurs.

These larvæ cause the shoots to "flag", and then gradually turn brown and die. These are Pith Moth larvæ, and they often do much harm to bush trees.

The moths belong to the Tineinæ. They have long, thin wings, edged with long fringes. The fore wings are black and rusty brown, and on the inner border some broken white marks. In *B. vinolentella* the head is black, in *B. hellerella* it is white.

The moths appear in July and August; where they lay their eggs we do not know. The young larvæ appear to live on the under side of the leaves in the autumn, and then make their way under the skin of the shoots near the base of a bud. In this position they form brown blister-like areas, which have a small opening into them. In spring they work up into the bud, and live there, finally tunnelling the stalk, where they change to an ochraceous and mahogany-coloured pupa in early July.

Treatment.—Nothing but hand picking the flagging shoots before the moths escape, and the pruning in winter of the parts with blistered area, and burning the same, does any good.

Apple-blossom Weevil (*Anthonomus pomorum*).—This small weevil, which is only $\frac{1}{6}$ in. long, is the cause of very serious loss to Apple growers. It occurs in Kent, Surrey, Cambridgeshire, Worcestershire, Herefordshire, &c. It is the cause of so-called "capped blossoms" (fig. 344).

The beetle is ashy grey, with a pale **V**-shaped area on the wing cases. It can fly, but is not very active on the wing. The female bores a hole by means of her long proboscis in the small blossom buds, and in each deposits a single egg. This changes into a creamy-coloured footless larva, which feeds on the inside of the blossom, which does not open, but which later turns brown and dies. Still in the blossom the maggot changes to a pallid pupa with dark eyes, and then the beetle hatches out, and escapes from the capped blossom by eating out a round hole in the side. The beetles live right through the summer on the trees, and in winter they hibernate under rough bark, moss, lichen, &c., on trees in and around the plantations. It sometimes attacks the Pear.

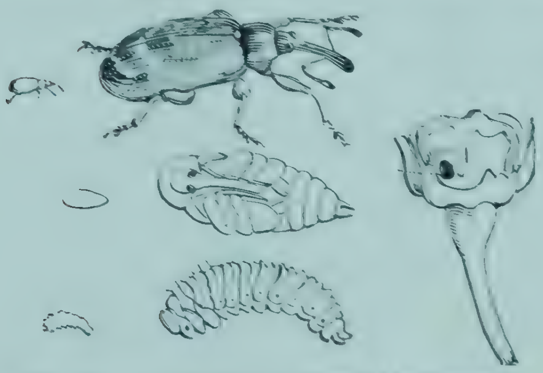


Fig. 344.—Apple blossom Weevil (*Anthonomus pomorum*) nat. size and magnified

Prevention.—Old trees should be cleansed in winter by spraying with either caustic soda wash or lime-and-salt wash, so as to destroy their winter quarters. The beetles may also be jarred off on to sheets or boards covered with tar when they are seen to have started to lay their eggs.

Apple Sawfly (*Hoplocampa testudinea*).—This Sawfly larva is very frequent in apples, and is often mistaken for the Codlin Maggot. It can be told from the latter by having more than four pairs of sucker feet, and by its eating out larger chambers in the young apples. A small hole is formed to the outside of the fruitlets, and through this is passed out a brownish liquid and excrement. The Sawfly appears when the Apples are in blossom. The female lays her eggs deep in the blossoms; as a rule, one only in each flower. The male and female both have four transparent wings and dark-and-yellow bodies, and are about the size of the Gooseberry Sawfly.

The larva will leave one fruitlet and eat its way into another, several fruitlets often being spoiled by one larva. By the middle of July the larvæ are mature, and have fallen to the ground, which they enter to winter in. In the soil they form silken and earthen cocoons, and in spring they pupate.

Treatment.—All that can be done is to hand-pick the attacked fruitlets as soon as they show signs of invasion, and burn them. In this manner it can be cleared out of gardens and plantations, if done thoroughly.

Mussel Scale (*Lepidosaphes ulmi*).—This scale insect or Coccid fig. 345) resembles a miniature mussel shell in form, about $\frac{1}{6}$ to $\frac{1}{8}$ in. long n the female and brown in colour, closely applied to the bark of the tem and twigs and sometimes on the fruit and foliage. The male scale s much smaller and truncated at ne end; it is rare.

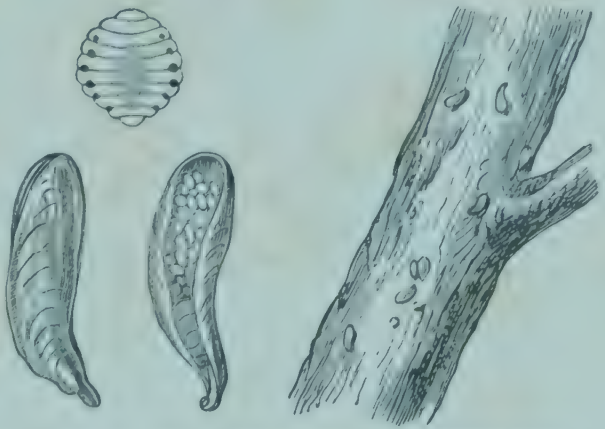


Fig. 345.—Apple Mussel Scale (*Lepidosaphes ulmi*)

These scales may encrust the rees so thickly that they die, specially young trees.

Not only Apple, but Pear, Currant, Hawthorn, and other plants re invaded by this insect, which is widely distributed over the world.

The female is a footless, fleshy body which lives under the scale with her long proboscis pushed nto the plant; she lays her eggs under the scale, and these we find all the winter. In June they hatch nto little active six-legged larvæ which crawl over the trees and sooner or later fix upon some definite abode; then they look like small white specks, and by degrees the scaly covering is built up. The male has wo wings.

TREATMENT.—Winter spraying with caustic soda or Woburn Winter Wash, and spraying when the larvæ are free, towards the end of June, with dilute paraffin emulsion.

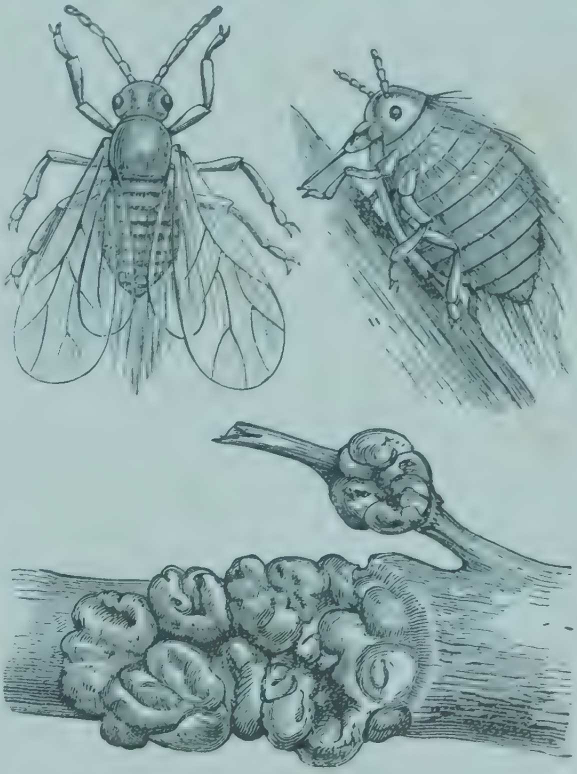


Fig. 346.—Woolly Aphis or American Blight (*Schizoneura lanigera*)

The Woolly Aphis (*Schizoneura anigera*).—This Aphis (fig. 346) forms a large quantity of white flocculent wool from its back. It lives mainly on the bark of the trunk, branches, and finer shoots of the Apple, but now and again on Pear, and abundantly on the Wild Crab Apple. It also lives on the roots of Apple trees, where it works in a similar way to the aerial form, sucking out the sap, and by the punctures of their proboscis they cause boil-like swellings on young wood, which burst and which later form large rough patches in the crevices of which the insects and others shelter.

The usual form is the plum-coloured wingless female, which is constantly producing pale-yellowish living young. In the summer a winged female brood may appear. The winter is passed amongst moss and lichen on the trees, under rough bark and grafting clay in the wingless female condition above ground, and also as wingless females below ground and on the roots near the butt of the trees. Now and again an autumnal sexual brood occurs, the oviparous female laying a single egg near the base of the tree, and her dried skin remains behind as a covering over it.

Treatment.—Spraying with paraffin emulsion will destroy the aphis in summer and autumn above ground, but the washing must be done with force; a strong jet must be sent to hit the patches of aphis in the crevices. There is an intimate connection between the Woolly Aphis and canker (see p. 89).

The ground form may be attacked by injecting disulphide of carbon into the soil, ½ oz. on four sides of the tree about 2 ft. from the trunk and about 6 in. deep, or the earth may be cleared away for 3 ft. around the trunk and the ground soaked with warm paraffin emulsion. In Australia, &c., it is found that the root form does not occur on "Northern Spy" or "Winter Majetin".

Apple Aphides.—At least three species of Aphis attack the Apple: (1) the Leaf-curling Aphis (*Aphis pomi*); (2) the Rose Leaf-curler (*Aphis sorbi*); and (3) the Green-shoot Aphis (*Aphis fitchii*).

The former is by far the worst Apple species and is said to live solely on apple. The black eggs are found in masses in winter on the year's growth of wood. In spring they hatch into small lice which spread out over the leaves. Soon they grow into wingless viviparous females of a slaty and mealy appearance. and these produce quantities of living young, which very soon are mature and ready to produce others. These wingless aphides cause the leaves to curl up and fall off, and as they also puncture the shoots the latter become deformed. Later in the summer winged broods appear and fly off. In autumn, about the beginning of October, they return and produce yellowish young, which become oviparous females and lay the ova on the shoots.

The Rose Leaf Aphis causes the curled leaves to become bright red and yellow. This species also lives on Hawthorn. The Stem Aphis is green and does not curl the leaves, mainly collecting in early summer on the shoots and below the leaves and in the blossom. It migrates between the Apple and various grasses.

Ants carry all these aphides from place to place and are always found in company with them.

Not only does *Aphis pomi* damage foliage and shoots, but in bad cases the fruit is attacked and deformed.

Treatment consists of heavy washings with soft soap and quassia or nicotine wash. If the former, it must be done before the leaves are much curled, as the wash will not enter the curled foliage; nicotine will, however, penetrate into the crevices and curls. Much good will also be done by heavy spraying with the same in autumn, to kill the egg-laying brood under the leaves.

All prunings should be burnt in winter, as many eggs are thus destroyed.

Apple Sucker (*Psylla mali*).—This insect (fig. 347) is found in most Apple orchards in Great Britain and Ireland, and is frequently the cause of much damage. It is one of the sucking-mouthed insects belonging to the Hemiptera. The adult is a small green insect $\frac{1}{10}$ to $\frac{1}{8}$ in. long, with four transparent wings. Both sexes are winged; the males become more brightly coloured in autumn. They can be told by their skipping movements and clear wings. The females lay eggs from September to November; they are small yellowish bodies, yet discernible by the naked eye, and are placed along the leaf-scar ridges, amongst the fine hair on the shoots, and even in crevices in bark; the eggs have fine tail-like processes. They remain on the trees all the winter, and hatch out just as the buds are swelling and are ready to burst; the small flat louse-like young soon enter the buds and commence to suck away the juices. Later, they become green flat nymphs with wing buds, and these hatch out into the adult suckers in June. Both larvæ and nymphs pass out long pale-blue or white threads from their bodies, and attached to these little threads are opaque oily globules. These, if we see them at the bases of the blossom trusses, where the larvæ feed on the stalks of the blossoms, or on the leaves, where we more usually find the nymphs, are sure signs of Psylla attack. The attacked trusses of blossom turn brown and remain on some time even into the winter.

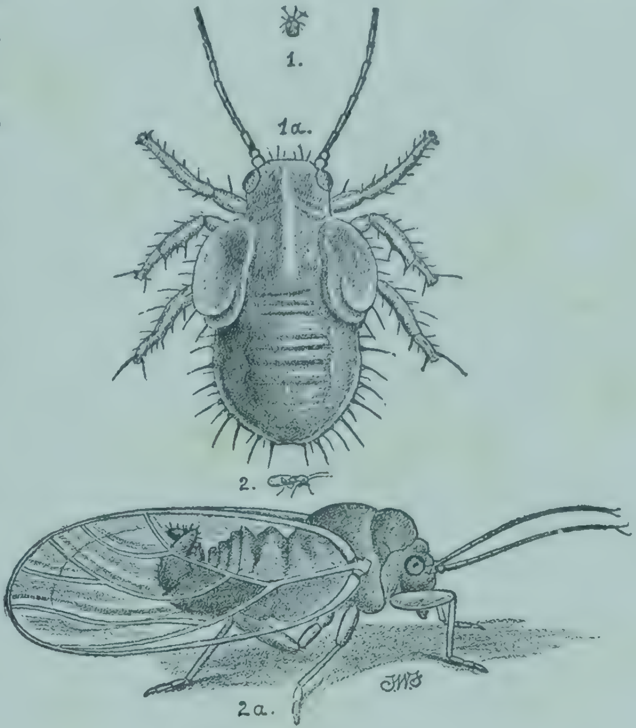


Fig. 347.—Apple Sucker (*Psylla mali*)

1 and 1*a*, Pupa. 2 and 2*a*, Imago (nat. size and magnified).

Treatment consists of (1) spraying with lime-and-salt wash, made as follows:—$1\frac{1}{2}$ cwt. fresh slaked white lime, 20 lb. salt, 100 gall. of water. This should be done as late in February as possible, or the first week in March. Many eggs are thus prevented from hatching out. (2) Spraying as soon as the trusses are opening out with (*a*) nicotine wash at rate of $1\frac{1}{5}$ oz. 98 per cent nicotine to 10 gall. of water, or (*b*) quassia-and-soft-soap wash at rate of 8 to 10 lb. of quassia, 6 to 8 lb. of soft soap, to 100 gall. of water. [F. V. T.]

It is only comparatively recently that this little insect has got itself into notoriety. Either its ravages were put down to some other cause—perhaps that broad-backed bearer of so much imputed guilt, the east wind—or else it had not propagated its species to such an extent as to cause noticeable damage. Now, however, it is able to create a serious disturbance of an Apple grower's prospects. A row of Apple trees given over to their ravages looks after a week or two of the experience as if scorched by the Sirocco.

Some sorts of Apples are more susceptible to the attack than others. "Ecklinville Seedling", "Gladstone", and "Devonshire Quarrenden" are among the worst. "Lord Grosvenor", "The Queen", "Lane's Prince Albert" will crop merrily, when the varieties first mentioned are browned, dejected, and fruitless on account of the Apple Sucker.

Various remedies are recommended. It was claimed for some winter sprays that they possessed the power of destroying the eggs; that claim has gone to the limbo of unfulfilled intentions.

The lime-and-salt spray is much believed in by some advisers of the fruit grower; whether any who have tried it remain true to the faith, it is perhaps too soon to know. It is claimed for this spray, or rather wash, that it seals up the embryo sucker in his egg, and thus makes it his tomb, and also that it cleans the tree of lichen and other harbours of hibernating insects. One thing is certain, it is a most unholy preparation to handle, and the grower who himself puts it on his trees deserves a certificate of immunity from all pests for years. [W. G. L.]

Other Apple Pests.—A very large number of other insects attack the Apple, including the following more abundant ones: The Gold Tail Moth (*Porthesia similis*); the Figure-of-8 Moth (*Diloba cæruleocephala*); Pepper-and-salt Moth (*Amyphidasys betularia*); various Tortrices (*Tortrix ribeana, T. podana*, &c.); The Small Ermine Moth (*Hyponomeuta malinella*); various Leaf Miners (*Lyonetia clerckella, Cemiostoma scitella*, &c.): Fruit Bark Beetle (*Scolytus rugulosus*); Cock Chafers (*Melolontha vulgaris, Phyllopertha horticola*); Leaf Weevils (*Phyllobius oblongus* and *P. maculicornis*); Oyster-shell Bark Louse (*Aspidiotus ostreæformis*); Brown Scale (*Lecanium capreæ*); Goat Moth (*Cossus ligniperda*), &c. For these and other Apple pests the reader is referred to my work on the *Insect and Allied Pests of Orchard, Bush, and Hothouse Fruits*. [F. V. T.]

§ 8. FUNGOID DISEASES OF THE APPLE

Apple Scab (*Venturia inæqualis*).—This is undoubtedly the most injurious fungus parasite attacking the Apple, and unfortunately it abounds wherever the Apple is cultivated. It is estimated that the annual loss due to "spotted" fruit caused by this fungus exceeds £1,000,000 sterling.

Until recently the fungus causing scab was known as *Fusicladium dendriticum*. It has, however, now been discovered that the Fusicladium is only the summer condition of a fungus which produces fruit the spring after its formation. This is the higher or Venturia stage. Naturally the scabs or black spots on the fruit are best known to horticulturists, but its occurrence is by no means confined to the fruit. If we take a tree that has produced scabbed apples for some years, proving that the disease is well established, the following is the yearly course followed by the fungus: The Fusicladium or summer condition is present in quantity on dead shoots and young branches. Its presence is indicated by the bark becoming broken up as if gnawed by some insect. Such wounds often occur at the base of the youngest shoot, or on fruit spurs, and are also sometimes present on older branches. The fungus itself is not very conspicuous, and appears as a blackish stain on the wood under the loose bark and on the bark itself. It is very important to grasp the fact that when a shoot or branch is once infected the spawn or mycelium of the fungus continues to grow from year to year, or is perennial in the branch and produces spores each season, and naturally the number of spores produced is greater each season as the mycelium spreads in the dead branch. Spores are produced on these diseased branches in the spring, and are washed by rain or conveyed by other means on to the young leaves, which in turn become infected, the presence of the fungus on the leaves being indicated by blackish olive patches of various size. If these patches are examined under a good pocket lens, they will be seen to consist of numerous crowded lines arranged in a dendritic manner, and radiating from the edge of the patch. This appearance proves with certainty that the patch consists of the fungus causing Apple scab. In due course the fungus present on the leaves produces spores, which in turn are carried by some means or other on to the young fruit, which in turn becomes infected. Spores are produced on the diseased shoots throughout the season, and these may also play a part in infecting the fruit.

From the above account it will be seen that when the branches of a tree are once infected, if such branches are not removed, the disease is capable of perpetuating itself from year to year without any infection from outside sources. At the same time such an infected tree represents a nursery of disease from which the fungus is certain to spread to adjoining trees.

Under the circumstances my advice is to remove all dead and decayed shoots, as by so doing you remove the primary cause of the disease. During the spring following the removal of the branches, spray with Bordeaux mixture (see p. 49), commencing when the leaves are unfolding, and again when the fruit is just set. A third spraying when the apples are about the size of marbles is advisable, as some dead shoots bearing spores are certain to be missed when pruning.

It is but fair to state that my view, as given above, is not endorsed by other specialists, who consider that pruning out the dead shoots is impracticable, and that by constant spraying alone the disease can be kept under control. Quite true; but if the primary cause of infection is not removed, the constant spraying must of necessity be repeated each season, and the "russeting" of fruit and scorching of foliage are the frequent results of spraying.

Brown Fruit Rot (*Sclerotinia fructigena*).—This is undoubtedly the commonest and most generally distributed of diseases attacking plants belonging to the family Rosaceæ, to which the majority of our orchard fruit trees belong. Until recently the injury was supposed to be entirely due to a fungus called *Monilia fructigena*. It has, however, now been proved that the Monilia is only one phase in the life-cycle of a more highly organized fungus called Sclerotinia. It is quite true that the Monilia condition causes all the damage, yet it is well to know that another stage exists, which under certain conditions is capable of tiding the parasite over from one year to another.

As usual, the effect on the fruit is best known to people generally, appealing as it does both to the eye and the pocket. On apples the earliest indication of its presence is the appearance of one or more small, brown patches which gradually increase in size, until in many instances the entire surface of the fruit becomes diseased. Soon afterwards whitish warts, arranged in concentric circles, resembling little fairy rings, burst through the skin covering the diseased parts. These warts are the summer fruits, or Monilia condition of the fungus. If a thin slice of one of these white warts is examined under a microscope, it will be seen to consist of numerous spores arranged in long chains, like strings of beads. These spores become free from each other when ripe, and are scattered by wind, &c., and are capable of infecting other fruits or young shoots. Such diseased apples do not rot and decay soon, but become dry and mummified, and often remain hanging on the tree until the following season (fig. 348).

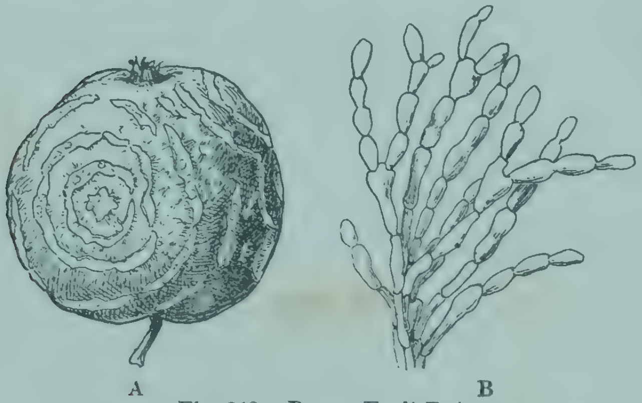


Fig. 348.—Brown Fruit Rot

A, Apple in mummified condition. B, Chains of spores.

Whether hanging on the tree or lying on the ground, such diseased apples produce a second crop of Monilia spores the following spring, each one of which is capable of infecting any leaf, shoot, or fruit on which it may alight. It sometimes happens that apples infected with this disease turn almost black all over, and are popularly known as "Black Apples". These become dry and hard, and do not produce Monilia spores until the spring.

When plums and cherries are attacked, the white warts of Monilia fruit are not usually produced in irregular circles as on the apple, but are irregularly scattered over the fruit. When diseased fruit has been lying on the ground for two seasons, and has become more or less buried, it sometimes produces the higher or Sclerotinia kind of winter fruit, under the form of little brown cups supported on slender stalks. The spores of this form are, of course, also able to set up an infection.

As in the case of "Apple Scab", the fungus attacks the young shoots, and on these continues to produce spores every season until the branch or shoot is removed, either by decay or by pruning. The disease is readily recognized on the shoots by the whitish, wart-like tufts of spores. These spores are the first to be formed in the spring, and are washed on to the young leaves, which in turn become infected and pass their spores on to the young fruit. When a tree has many infected shoots, and spores are produced in abundance, the blossom is also often attacked. This is more especially the case with the Cherry, where the fungus forms minute, velvety tufts on the flower stalks, sepals, and petals, which in consequence turn brown and die, but often remain hanging on the tree for some time. Such effects are almost invariably attributed to frost.

The only method of getting rid of this disease permanently is to strike at the root of the matter, which means that, in the first instance, all diseased shoots should be removed and burned. If this is not done, and the admitted primary cause of the disease is allowed to remain, then repeated spraying every year becomes a necessity. The next thing to attend to is the removal of all dead, mummified fruit, whether hanging on the trees or lying on the ground. This should be burned or deeply buried, and not given to animals to eat. Next, spray with Bordeaux mixture, first when the leaves are expanding, and again when the fruit is just set. After such precautions, which should be repeated a second season, the disease will be well in hand.

Apple Rot (*Glomurella rufo-maculans*).—This disease is by no means new nor rare amongst us, although until recently the fungus concerned in its production was known as *Glœosporium fructigenum*. The last-named, however, is now known to be only one stage in the life-cycle of a higher condition called Glomurella.

The injury to the fruit is best known to growers. It first appears at scattered points—rarely more than two or three on a fruit—as a small brown speck showing through the skin. These spots gradually increase in size, at the same time changing to a darker-brown colour, and the surface of the diseased patch gradually sinks below the general surface of the apple, owing to the collapse of the tissues. At this stage the diseased portions have a very bitter taste; hence the disease is known as "bitter pit" in the United States, where it is quite as prevalent as with us; in fact it is estimated that the loss through this disease in the United States amounted to 10,000,000 dollars in 1900. Numerous summer spores are produced on the sunken patches, which frequently extend to such an extent that they run into each other, and frequently almost cover the surface of the fruit. The disease hastens the period of ripening, and causes the fruit to fall early in the season.

The disease is by no means confined to the fruit, in fact the fruit is infected by spores of the fungus growing on diseased portions of the branches. The fungus, when present on the branches, forms canker-like patches, blackened and more or less sunk below the surface, and the bark is killed for some distance round such diseased patches. These cankered patches, if allowed to remain, produce spores each season in succession, which infect the young fruit. The cankers form on the previous year's fruit spurs, also on branches up to 3 in. in diameter.

Smaller branches and spurs showing the disease should be removed, and cankers should be cut out of the larger branches, and the wounds at once coated with gas tar. When the fruit is attacked when quite young, it usually remains on the branches in a mummified condition until the following season, when fungus spores are produced that infect the young fruit. All such hanging diseased fruit should be removed, as should also all diseased fallen fruit. Pigs are quite capable of accomplishing this object, if for other reasons they can be allowed to enter the orchard.

Where the disease has existed, the trees should be sprayed with Bordeaux mixture, half strength, the first application, commencing just when the fruit is set.

Apple-tree Canker (*Nectria ditissima*).—This disease is much more prevalent now than in past times; reasons for this will be given later. As a rule it is popularly believed that canker is the result of a tree growing under unfavourable conditions. This is not correct, the disease is directly due to the action of a fungus, but at the same time the fungus may be greatly assisted in its work of destruction by the tree being weakly, due to bad cultivation or other causes. The symptoms of the presence of canker, as the name denotes, are a rugged or cankered appearance of the bark, which often commences in the fork of a branch. When first attacked, the bark usually shows several cracks arranged in a concentric manner, and as the bark is killed by the fungus it becomes dry and falls away, exposing the wood, which is also eaten away. A callus forms at the edge of the wound, which in turn is attacked by the fungus and killed here and there, producing a rugged mass round the edge of the wound, which continues to increase in size year by year. If the bark or callus near the edge of a canker wound is carefully examined with a magnifying glass, clusters of minute red bodies (fig. 349) smaller than the head of a small

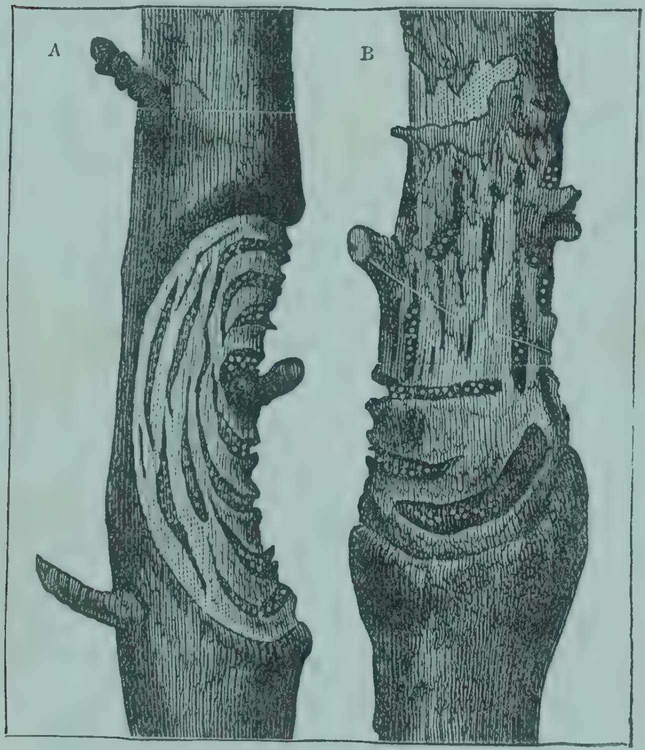


Fig. 349.—Apple-tree Canker (*Nectria ditissima*)

Branches of an apple tree showing the bark destroyed by the fungus. The little white points in the cracks on the diseased parts are the fruits of the fungus, which are of a bright-red colour (natural size). (*Gard. Chron.*)

pin will be seen. These are the fruits of the fungus. When small branches are attacked, the fungus often completely destroys the bark, and eats into the wood to such an extent that the branch breaks at the injured point.

The Nectria is a wound parasite; that is, it can only gain an entrance into the tree through some wound, which need not necessarily be very large. Wounds in the fork of a branch are often caused by the wind twisting the branch and causing a slight cracking of the bark where the branch springs from the trunk, or by the branch being pressed down by snow. Into such minute cracks the spores find their way, and set up the disease. When canker appears on the smaller branches it almost invariably arises in those places where the bark has been injured by the Woolly Aphis, or American Blight, in fact it may be truly stated that canker, as a serious disease, appeared for the first time after the general spread of American Blight. The Nectria attacks various other trees, as Beech, Oak, Hazel, Hornbeam, Maple, &c., but in no instance has it increased to the extent of becoming a serious epidemic, except on the Apple tree, because there alone it is aided by the wounds made by American Blight.

Where the disease has gained much headway the branches should be removed, as the mycelium of the fungus spreads in the wood considerably beyond the wound. In the case of slight wounds the diseased portion should be cut away, going well beyond the boundary of the wound; the scar should at once be painted over with a coating of gas tar to insure against further infection. Methods should be adopted for the destruction of American Blight, care being taken to remember that this pest frequently hibernates on the underground part of the trunk, or the collar, during the winter months. [G. M.]

"Stirling Castle" will canker miserably when planted on heavy land, but will grow healthily without signs of it on a light land, with plenty of manure in it.

"Hawthorndens" will canker as if smitten with leprosy on thin, poor, chalky soil, but will maintain a healthy vigour for years upon a generous soil. When once an Apple is attacked badly with this fungus it is a difficult matter to get rid of it. Probably by the time this occurs some other sorts on the plantation have given evidence that they are happy, and if they or any of them also crop well, and the fruit sells well, the cheapest course in the long run may be to do away with the cankered variety and substitute one that has proved its suitability to the soil and situation. The late Mr. T. Rivers gave a formula of manures to cure canker; it was quoted by Mr. Wise in his paper before the Royal Horticultural Society already referred to. One should receive with the greatest respect any advice backed by the exceptional knowledge and experience which was possessed by the late Mr. Rivers, but one may doubt whether any given combination of manures can be expected to be applicable to every soil, or to meet the difficulties of every variety of Apple that finds itself unable to resist the attacks of the fungus. When the long-talked-of Government experiments in fruit growing are inaugurated, and if by chance it should happen that they were practically managed, it may be possible to discover what it is that is out of alignment between certain soils and certain varieties of Apple that reduces the vitality of the tree so as to place it at the mercy of the canker fungus.

At present, from such observations as are possible to a non-scientist, it seems that certain varieties of Apple will do well in soil A, and canker in soil B, while others will do well in soil B, and canker in soil A.

In order to check the spread of the spores, and to give the tree a chance of overcoming the attack, a good plan is to spray in the late winter, just before the buds begin to burst, with a solution of sulphate of copper, 1 lb. to 36 gall. of water; the spray should be driven hard into the canker sores.

[W. G. L.]

Heartwood Rot of Apple Tree (*Polyporus hispidus*).—Not infrequently large, bracket-shaped fungi may be seen growing out of the trunk or branches. These fungi are more or less semicircular in outline, and vary from 4 to 8 in. across. The upper surface is brown and coarsely velvety, the under surface greenish and porous. The spawn of the fungus penetrates to the heartwood, which it reduces to powder; consequently the trunk becomes hollow. The fungus attacks all kinds of fruit trees, also many forest trees.

The fungus should be removed at once, otherwise the spores produced are apt to infect adjoining trees through wounds. Cover all wounds with gas tar. Certain other kinds of woody bracket fungi also grow on fruit trees, to their detriment. They should be dealt with as above.

Bitter-pit of Apples.—This disease appears to be prevalent wherever the Apple is cultivated. The symptoms are: the presence of scattered brown or rust-coloured spots in the flesh of the apple, more especially towards the calyx or "eye" end of the fruit. When the spots are near the surface the skin sinks over the spots, and the apple presents the appearance of having had smallpox. No fungus nor insect is concerned with this disease, which is of a physiological nature, and no knowledge as to a cure or preventive is at present known. It has been suggested that, in new countries where the Apple is grown, it is due to the introduced trees having not as yet become acclimatized. This, however, is not a satisfactory explanation, as many kinds of Apple suffer severely in this country where the varieties were produced from trees that have been in existence here for ages.

Apple-tree Mildew (*Sphærotheca mali*, Magnus).—This disease is caused by one of the superficial mildews, related to the Hop Mildew, American Gooseberry Mildew, &c. It is widely distributed in this country, and probably exists wherever the Apple is cultivated. The young leaves clustered at the tips of the shoots present the appearance of having been thickly dusted over with flour, and the action of the fungus is to arrest the growth of young shoots, consequently the formation of new wood is prevented when the parasite is present in abundance.

When the fungus is present in small quantity, spraying with Bordeaux mixture, or with a solution of liver of sulphur, may arrest its progress; but when present in its worst form the only certain means of restoring the tree to health is to cut off and burn all the diseased rosettes of leaves. During the following spring the pruned trees should be sprayed with Bordeaux mixture. Trees thus treated throw out healthy shoots.

As the winter fruit is rare, and not in sufficient quantity to account for the enormous development of mildew each season, it is supposed that the mycelium of the fungus persists over year in the tips of the shoots. Hence the necessity for removing these.

All suckers should be removed, as the mildew often commences on them, and it is there where the scanty amount of winter fruit is mostly produced. [G. M.]

PEARS

§ 1. GENERAL

The garden Pear has originated from *Pyrus communis*, a native of Britain and the temperate parts of Europe and Asia, and is therefore a perfectly hardy fruit. Like its cousin, the Apple, it has undergone marvellous transformations at the hands of the gardener, and its modern varieties may be said to have reached almost the acme of deliciousness so far as flavour is concerned. And yet with all its claims to popular favour the Pear is not nearly so extensively cultivated as the Apple. Indeed, judging from the Returns of the Board of Agriculture, there are about 9830 ac. under Pears in Great Britain and Ireland, against 178,548 ac. under Apples. There are therefore about nineteen times more apples than pears grown at present. England is the greatest, indeed one might almost say the only Pear country, having 9163 ac., leaving 226 to Ireland, 186 to Scotland, and 69 to Wales. The Isle of Man is credited with 1½ ac., and Jersey—so famous for its Pears—has 37 ac. devoted to their culture. The greatest Pear-growing county seems to be Gloucester, with 2046 ac.; then Worcester, a good second, with 1591 ac. Hereford is third with 1367 ac., and Kent is fourth on the list with 847 ac. Little Middlesex is the fifth Pear county with 343 ac.; and Chester, Monmouth, and Lancaster follow with 242, 203, and 236 ac. respectively. There seems to be plenty of scope, therefore, for increasing the cultivation of Pears in the British Islands, especially in Ireland, which has a climate of great possibilities.

Large quantities of pears are imported into the United Kingdom every year, a fact indicating the great demand for such a fine fruit. According to the returns of the Board of Agriculture for 1911, 578,309 cwt. of "raw" pears, valued at £536,982, were imported from the following countries: France, 225,851 cwt.; Belgium 162,783 cwt.; United States, 132,946 cwt.; Australia, 28,608 cwt.; Holland, 10,464 cwt.; Canada, 6,811 cwt.; Germany, 5,644 cwt.; and the Cape, 5,202 cwt. While the imports from Belgium and Holland have declined somewhat since 1907, they have gone up in leaps and bounds from the United States, which only sent us 24,000 cwt. in 1907 against 132,924 cwt. in 1911, an increase of 108,946 cwt. in four years.

Pears are grown very much in the same way as Apples and Plums, but are probably more mixed with these two fruits. Taking as a basis for computation 160 Pear trees to the acre (there are probably twice that number), it would mean that there are at least 1,575,000 Pear trees in the United Kingdom. Assuming an average crop of 2 bus. of fruit to each tree, the annual crop of British pears would be something like 3,150,000 bus. or about 56,000 tons—about twice as much as the imported produce. At the rate of £10 per ton the annual value of the pear crop would thus be about £560,000, somewhat more than the declared value of imported fruit.

It is stated in Mr. Bunyard's *Fruit Farming for Profit* that the average yield per acre for pears is 2 tons. This seems to be a curiously small crop in normal seasons, averaging only 28 lb. per tree at 160 trees to the acre. If a greater number of trees to the acre than 160, the average yield per tree would of course be much less than 28 lb., and would not pay any market gardener to grow. We have known some Jargonelle Pear trees, well established and with plenty of space, yielding an average of 8 bus. per tree for many years.

The annual receipts and expenses from an acre of established Pear trees may be estimated as follows, reckoning 160 trees to an acre, and not taking into account undercrops:—

RECEIPTS

160 trees, 2 bus. each, at 3*s.* 6*d.* per bus. = 320 bus.	£56	0	0

EXPENSES

20 tons of manure at 6*s.* per ton	£6	0	0
10 cwt. basic slag at £2, 10*s.* per ton	1	5	0
Cost of spreading manure	1	10	0
Pruning	1	0	0
Hoeing	2	10	0
Picking 320 bus. at 6*d.*	8	0	0
Rent, rates, and taxes	10	0	0
Miscellaneous	5	15	0
	£36	0	0
Profit	20	0	0
	£56	0	0

Like all other estimates, the only fairly sure thing about the figures is the expenses. If market gardeners could rely every year upon a crop of pears yielding £56 per acre, they would probably be happy. But it is well known that in some seasons not one-half of this amount is obtained. The only item in the expenditure then saved is that of picking and marketing, but these in no way compensate for the poverty of the crop. On the other hand, it must be borne in mind that a properly cultivated Pear garden, with 160 well-established trees, ought to yield more than an average of 2 bus. per tree. Where there are 300 and 400 trees to the acre it is impossible to expect anything but poor crops, and fruit perhaps badly diseased into the bargain.

Pears on Walls.—In many market gardens there are either walls or fences that may be, and are, utilized for the cultivation of some of the choicer or more tender varieties of Pears. The trees may be trained on the walls in various ways, either as single oblique cordons or as double oblique cordons (fig. 350); in the forms of single or double columns (fig. 351), shapes useful for the butt end of walls; or they may have the branches trained horizontally, or radiating like a fan.

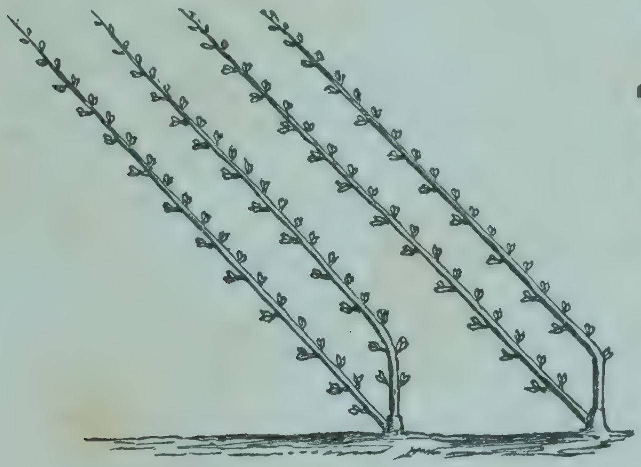
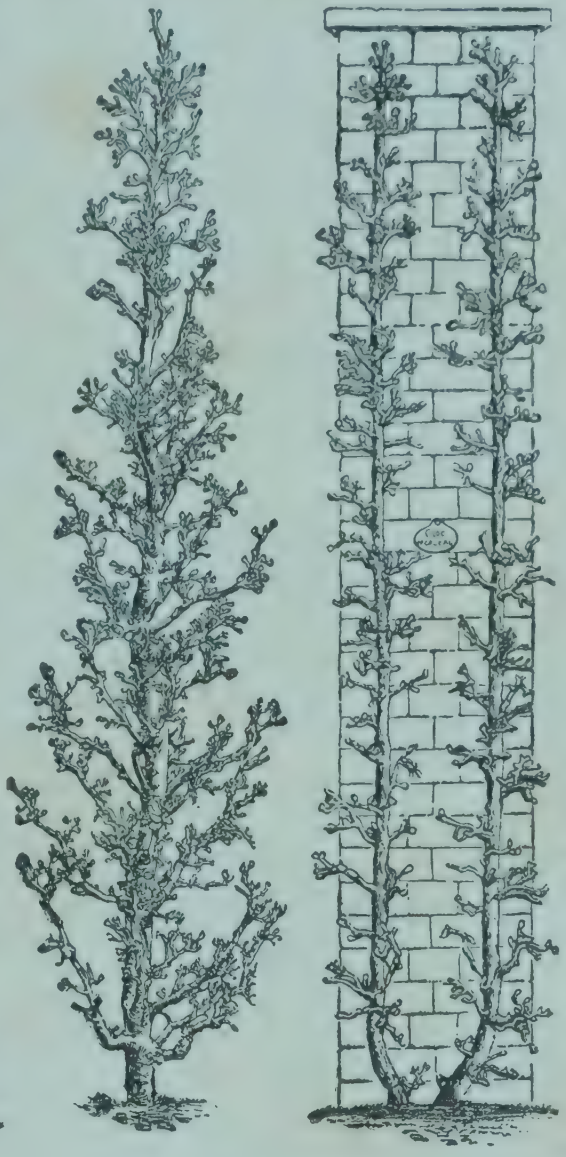


Fig. 350.—Double Oblique Cordons



Columnar

Fig. 351

Double Cordon

Whichever method is adopted means more expense in cultivating than trees grown as bushes, half-standards, pyramids, or standards. The extra expense will be entailed in tying, nailing, summer pruning and pinching, and also in winter pruning, and the only set-off against this expense would be in having particularly fine fruits that would realize something like one-half or a quarter of the big prices at which they are retailed at the west-end shops.

In market gardens sufficient attention is not given to the proper pruning of fruit trees on walls. The men employed are usually unskilled in the art of gardening, and they often know little or nothing as to the difference between fruit buds and wood buds on a tree. The result is often deplorable. The best flower buds are destroyed, and numerous sappy growths take their place season after season. The natural result is no fruit, waste of money, labour, time, walls, nails, shreds. For these troubles the weather, frost, foreign competition, and all sorts of things except the real cause—the ignorance of the pruner—will be blamed, and fruit growing on walls for market purposes will be voted a rank failure. It would be found more economic and certainly more profitable to employ trained gardeners in all matters appertaining to the pruning and cultivation of fruit trees, and more especially when grown on walls.

To keep Pears in a good fertile condition on walls, attention must be given to pinching back the young growths during the summer months. When 1 ft. or 18 in. in length, the tips should be pinched out with the finger and thumb, or the shoots may be cracked and half-broken through, so that they hang down. This stops further increase in length, without causing the basal buds to start into twiggy shoots, but rather to remain dormant and gorge themselves with the food that has been elaborated by and in the leaves. Such shoots are shortened back to two or three buds in winter. In the case of Pears, Apples, Plums, and Sweet Cherries, the fruit spurs mostly form on branches from two to seven years of age, and may be distinguished even in the summer months by their short stumpy growth, and by the cluster of leaves around them. [J. W.]

Cultivation for Market.—The Pear may be taken to be a much less important item in the market fruit plantation than either the Apple or the Plum. It has not become so generally accepted as a food, and still is regarded somewhat in the light of a luxury. Its value when cooked does not seem to be widely appreciated, and, so far, the magicians of the kitchen have not made popular any methods of dealing with the pear to form a counterpart to the apple dumplings, apple tarts, and the various other confections in which the apple plays a prominent part. For this the pear itself does not seem to be at fault, but rather, perhaps, that tendency in human nature which induces us to keep to the old paths that the fathers trod, unless forced by something in the nature of an earthquake to seek fresh ones, for stewed pears form surely one of the most tasty of fruit dishes, and it can scarcely be doubted that cooked pears could be made attractive in many forms, and who knows but they might be made even to offer an alternative to the ubiquitous banana!

Pears are much more particular as to soil than Apples; they need light, warm, open soil, with plenty of sand in its composition. They like moisture and good drainage.

Without any question the best advice to a planter as regards Pears is: plant them if you have "pear land", and you will find no kind of fruit give you more satisfaction, but if you plant them on land that is not "pear land", nothing you do will produce more disappointment.

A distinguished professor, in the course of a paper on spraying, read to a meeting of agriculturists, called attention to the samples of pears one sees sometimes exposed for sale, especially in provincial markets, and after ridiculing the cracked and gnarled appearance of many of them, said that by proper spraying all these deformed specimens might have been healthy, shapely fruit. If the trees from which they came had been planted in uncongenial soil, you could no more get healthy fruit from them by any amount of spraying than you could restore health to the victims of consumption by applications of the best-advertised soap.

Mr. Owen Thomas, in *The Fruit Garden*, gives directions for taking out the natural soil to the depth of 2½ ft., where it is too cold and clayey, or too light and poor for Pears, and substituting for it a mixture of turf carefully cut into blocks of the size of bricks, road scrapings, mortar rubble, horse manure, and ¼-in. bones. It scarcely needs pointing out that such procedure would be too expensive for the market grower who desires to make a living from the profits of his operations. There is enough suitable soil in parts of the country where the climate is warm enough for Pear culture to shut out, from the prospect of paying, any plantation where so much elaborate preparation had been necessary. Where a good wall exists running from east to west, it *might* pay to do something of the kind to get Pears on its south face, and in planning the buildings for a new place such possibility might be taken into consideration.

Pear Stocks.—The planter of Pears has the choice of two stocks upon which they may be budded or grafted, namely, the Pear and the Quince. On the former the many fine specimens of Pear trees seen in old gardens have been grafted. Some of them are of great age, with trunks like forest trees, and still carrying heavy crops of fruit.

The characteristics of trees on the Pear stock are vigour of growth, deep rooting, and slowness of coming into bearing (although to this last there are exceptions). On the Quince stock the tree grows slowly, makes fruit spurs quickly, and bears finer fruit, as the root tendency is to form a mass of fibrous rootlets near to the surface. Pears on the Quince are able to adapt themselves to a slightly wider range of soils than on the Pear. In planting, the tree on the Quince should have the place where scion and stock unite put 2 in. or so beneath the level of the soil; on the Pear stock the tree must not be put in so deep. The difference of stock sometimes gives rise to a wide divergence in the appearance of the fruit. If specimens of "Durondeau" and "Clapp's Favourite" from trees on the Pear and the Quince stock are placed side by side, it will be sometimes difficult to recognize that the fruit from the different stocks are of the same variety.

When on the Pear stock the wood should be shortened back each winter to about one-third the previous summer's growth, always making the cut just above an outside bud. Care must be taken not to leave more shoots than will be necessary to form the main limbs of the tree. Some varieties, like the "Hessle" and "Emile d'Heyst", will fall into line readily; others, like the Jargonelle, will persistently choose the wrong road, and require careful training. After the fourth or fifth year it will only be necessary to take out the "sprew" or spray wood that will come each season along the branches, and to thin out where the growth of wood is likely to produce entanglement.

On the Quince, most Pears lend themselves easily to training in the pyramid shape (fig. 352), although some varieties, like "Conference", take more readily to the bush form. It really does not matter in a market plantation, and the wisest course is the line of least resistance.

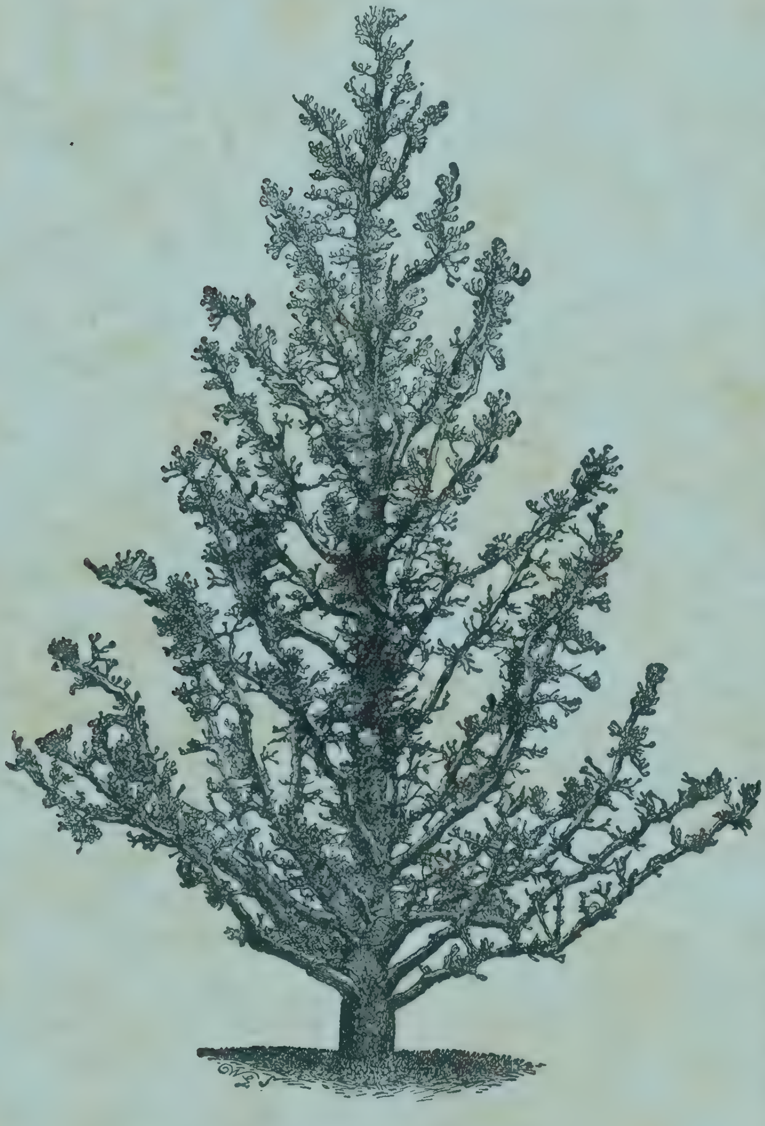


Fig. 352.—Pyramidal Pear Tree

It does not pay to plant the common varieties of Pears, that come to the cheap barrow trade, on the Quince. This stock is only suitable for such as will produce table fruit that will realize a decent price; then the tree will pay for summer pruning. This consists in shortening all the latest growths except leaders, during the latter end of July or beginning of August, to one-third of their length; afterwards, in winter, spurring them back to two or three eyes.

Pears that are worth planting on the Quince will pay for thinning in the spring after the fruit has set, and has escaped the attentions of the Pear Midge. All varieties of Pears are liable to overbloom themselves and waste the energy that should go to producing fruit in making of themselves a spring glory. When on the Quince this tendency can be checked somewhat by taking off superfluous bloom spurs before they open in the spring. In the case of full-grown trees on the Pear stock this would mean so large a contract that most growers will prefer to leave this matter to nature.

Pruning.—When a plantation is first started, pruning seems such an easy matter—and to any gardener with the right spirit within him it is an attractive and interesting occupation, calling as it does into exercise those faculties of judgment, foresight, imagination, and restraint that go to the painting of a picture or the writing of a book—that all sorts of resolutions are formed that the trees and bushes shall be constantly attended to and personally trained from year to year, so as to become living witnesses to the master's care; but each year the task grows heavier, until long before the plantation has reached maturity it has become an expensive item of organization. There are some jobs on a market garden that must not be governed by the sole consideration of the cost at the moment; for instance, a special place of punishment ought to be reserved for the gardener who leaves weeds to go to seed, even at path sides and odd corners. The public ought to be protected against having to look at such spectacles of neglect, and the State ought to be saved from the expense which will be involved in the crop of evil habits that will ensue through the subtle medium of suggestion. The pruning of the fruit trees, however, is not such a matter, and must be decided by considerations of how much will pay to do, and unless the grower has strength enough to do it easily, instead of summer pruning and spurring, after the fourth year, all that will be necessary to maintain the trees in bearing will be to shorten shoots of a too vigorous growth, to take out crosspieces, and to remove broken and dead branches.

Pears are very variable in their habits when on the Pear stock: some are as spreading as any Apple, and require as much room; others are upright and compact, and lend themselves to planting in alternate rows with Plums better even than most Apples. The distance for their planting will be about the same as that already given for Apples. When on the Quince stock it is generally found more convenient to plant Pears altogether at about 3 yd. by 4 yd., and to plant Strawberries among them for the first three or four years, than to leave all the ground to them, except, perhaps, for a crop of spring-flowering bulbs.

When dealt with in this way it is a good plan to give Pears a mulching of stable manure in the autumn of every third year. This has the effect of keeping the soil open and friable, besides feeding the trees and alluring the roots to the surface. The cost of wheeling on and spreading the manure, if the roadways in the plantation are wisely arranged so as not to have the rows too long, will be 30*s.* per acre. The cost of the manure will vary, according to the distance from town and railway station, from £10 to £16 per acre. The cost of pruning, commencing at 3*s.* per 100 trees, will increase to 1*s.* 6*d.* per dozen if summer pruning and spurring is continued, but need not get above 9*d.* per dozen if the trees are left free after the fourth year. Hoeing will cost £2 to £2, 10*s.* per acre. If no bulbs are grown after the Strawberries, and the land is turned over with the fork in the winters when the mulching is not done, this will cost £2 per acre.

Pears on the Pear stock vary greatly as to the time they come into bearing after planting. Probably the planter will restrict himself to those varieties that come into bearing at the fifth year, when the produce may reach £7 or £8 per acre, going ultimately up to £50 or £60 an acre for a full crop. On the Quince, by the fifth year the trees can make good show of fruit, and if the soil is quite suitable a gross return of £60 or more an acre can be obtained in a good year, when the trees are ten to twelve years old, if proper care has been taken with the picking, grading, and marketing.

The cost of picking will be found the same for Apples and Pears—on dwarf trees, with fair crop on, from 1½*d.* to 2*d.* per bushel; on half-standard trees, from 2½*d.* to 4*d.* per bushel, according to denseness or otherwise of the under crop and the consequent difficulty of working the ladders. Of course no hard-and-fast rule can be laid down; the prices are as variable as the amount of the crops. In mixed plantations of Apples, Pears, and Plums, with average crop and conditions, the usual price is 6*d.* per bushel all round, including "running" the plums where necessary.

In Mr. Theobald's work on *Insect Pests of Fruit* the list of those injurious to the Pear extends to twenty-eight, some of them with names more terrifying than the Greek deities, and it is no wonder if the prospective planter pauses when he finds that he must fight such a phalanx of foes. He may, however, be reassured, for from many of them he will receive little injury, unless he attempts to pronounce their names!

By far the most serious of them is the Pear Midge. Its presence will be readily detected by the abnormal swelling of the fruitlets a week or two after the blossom has fallen. One knows that those which are fertilized and are making a bid for life quickly stand out from the others and commence growing, but the effect of the Pear Midge cannot be confounded with this natural swelling. The fruitlets affected rapidly take on an appearance of swelled head, becoming enlarged at the blossom end and shrinking at the stalk end. If they are cut open, a little brown speck is seen just below the top, in a week or two longer the fruitlets fall off, and then, if they are opened, they will be found to be rotten inside, and to contain several small white grubs. The more choice the Pear the greater the mark it seems to be for this pest. No remedy appears yet to have been discovered that can be called in any sense effectual. In the case of dwarf trees the affected fruitlets can be picked off and burnt with the grub in them; but this is impossible where large trees are concerned, and until all growers agree to take measures alike, it is difficult to say of what use it is one grower here and there even picking off the infested fruitlets, if the majority are content to leave the matter to nature, as their fathers did before them.

A Plea for Co-operation.—This introduces one of the most difficult questions of market-garden politics, indeed of agriculture generally. The old race of farmers, from which the ranks of market gardeners have hitherto been principally recruited, is so splendidly independent, and so inveterately individualistic, that combination among them is almost impossible to attain. They will readily follow a lead when once there has been proof positive that it is a lead to advantage; but to meet together and submit plans and business arrangements to the dictation of others is an interference with individual liberty of action which they cannot brook. It is true that some method of compulsion like that in force for sheep dipping might be adopted. The only justification for such action, however, is that the scientist has put forward something which by actual practice has been proved to be an effective remedy. It can scarcely be said that in the matter of pests of fruit trees anything at present on the market is entitled to be called absolutely effectual. There are many preparations which are a great assistance to the grower in combating the attacks of his enemies; but this is the most that can be said.

It cannot be doubted that an agreement among all the growers in a district to take common action with any measures which, after due investigation, commend themselves as the best, if carried out loyally, would lessen the depredation of the pests against which the action was directed in that district. If once the imagination of market gardeners, or better still agriculturists generally, awoke to the mine of benefit lying waiting to be worked by combination and mutual confidence, they would sink a shaft at once. A great deal has been said about a Government fruit farm for experimental purposes, and demands are made for State aid in other directions. It is curious that extreme individualism and grand independence should be driven by their own centripetal force to lean on Government action. Agriculture, besides being the oldest, is still far and away our greatest industry; a little infusion of the spirit of buoyancy and enterprise, a little softening of ancient prejudices, a little opening of the lungs to the air that blows from the hills of high endeavour, and agriculture would have its own experimental farms, conduct its own investigations, even perhaps have a home for its Central and Associated Chambers!

To return for a moment to the question of compulsory treatment, there is this difficulty with pests that attack fruit trees, which does not exist in the case of animals: you can order all the sheep to be dipped and see that it is done, you can order all the fruit trees to be sprayed and *may* get it done; but then you have but touched the fringe of the matter, for forest trees may be as acceptable, as hosts, to the pests, as fruit trees, and it will be admitted that the compulsory spraying, for instance, of giant elms is a tall order; yet much of your spraying of fruit trees may be rendered nugatory unless you do it. (See Vol. I, p. 171.)

The fungus that produces scab on the Pear as well as on the Apple will probably cause the Pear grower some annoyance. It will be impossible to produce fruit of presentable appearance if this pest is allowed to run unchecked. A good caustic spray in winter, and two or three sprayings with Bordeaux mixture in spring and summer, should keep it down.

Pear Thrips have been reported as causing some damage by attacking the blossoms and fruitlets. Professor Theobald recommends a dressing of Kainit round the trees before the buds open, and says tobacco wash has been found effective. The latter is, however, rather expensive and will not pay to use unless the pests are numerous, and its effect very beneficial.

§ 2. PEARS TO GROW FOR MARKET

As in the case of Apples, the list of Pears in the catalogue of a nurseryman is bewildering in the number of varieties offered. The market gardener growing Pears wants the earliest he can get, and should have a succession up to the beginning of November. If he has Pears that require keeping longer than that, he will find the constant looking over which will be necessary swallow up the profit in expenses, unless he happens to be in a situation with soil and climate so specially adapted that it pays him to make Pears his speciality. The ordinary market grower will find that a Pear which crops, though dismissed by experts like Mr. Bunyard as "second" or even "third class", will pay him much better than the "delicious", "melting", "first-class" varieties which only deign to produce a crop when all conditions are quite favourable.

The Duck Egg.—This is an old-fashioned Pear, the mention of which will make the expert reader smile. It is, nevertheless, a useful variety for the market grower. Its growth is upright and compact, it is a good cropper, sells well for the barrow trade, and can be put on the market in the home counties at the end of July. It is only suitable for the Pear stock, and makes a good wind shelter for the rest of the plantation.

Jargonelle.—This old Pear is still unbeaten for an early market fruit. The tree is very vigorous in growth on the Pear stock and often a puzzle to prune. It takes five to seven years to come into bearing, but then it nearly always bears and the fruit sells freely. It is early-flowering, and its large white blossoms borne in trusses of six or eight make it quite the most beautiful of all Pear trees. It is apt to canker on cold soils; on such it should receive frequent dressings of lime and spraying, when dormant, with the copper sulphate spray recommended for Apple canker (p. 90).

Lammas.—This early variety seems always to meet with a ready sale in London; it is one of the oldest Pears in cultivation. Some trees in Middlesex are probably 200 years old. It is a heavy cropper, the fruit is small, the colour yellow, and the flesh "flocky". It is ripe at the end of July. The tree wants age before coming into bearing.

Hessle.—This is a hardy Pear freely grown in the home counties. It is a free bearer and flourishes on a wider range of soil than most Pears, although to get its pretty spotted skin clear from rust it must be planted on deep light soil. Many thousands of bushels of this pear are sent from London by sea to the north of England and Scotland during the first weeks of September. It sold ripe in London in 1910 at 7s. per bushel. The tree easily takes an attractive shape, and after the first few years requires little pruning. Although classed as a common Pear, to use an old aphorism, it will buy the horse while some so-called better varieties are buying the harness.

Calebasse Bosc.—A long brown pear with russet skin and tree of slender, weeping growth. When planted on light deep soil it is a profuse bearer. The fruit should be gathered just before Michaelmas, as its long slender stalk allows it to sway on the tree, and an autumn gale will give the grower the unpleasant surprise of finding his Calebasse gathered for him in the night, and injured also. It is not worth planting on unsuitable soil.

Beurré Capiaumont.—A profuse bearer. As the tree is of upright growth it should be planted at the end of rows where a roadway is left, where a drooping or spreading tree would be injured by the passing of vans or trolleys. It is fit to gather at the beginning of October.

Durondeau.—A pear very much like the one just mentioned, but larger and of better quality. The tree has a similar upright growth, but is not so hardy, and though a good cropper is nothing like so sure as the Capiaumont.

Fertility.—This Pear is certainly rightly named. It is probably the heaviest bearer among the Pears. The tree has an awkward tendency to run up, and the lateral branches nearly always want propping. When the crop is heavy, or the season dry, the fruit runs small. The quality is poor, but the tree pays to grow where Pears will grow at all, because of its fertility. It is apt to canker and requires the copper sulphate spray in the winter. It is fit to gather at the beginning of October.

Emile d'Heyst.—This is the best-quality Pear yet mentioned. It is of regular, fairly upright growth; a good bearer. Wants gathering at the beginning of October, and keeping a week or two before sending to market.

Winter Windsor.—This is a Pear grown in Middlesex and Essex; it is a prodigious bearer. The tree is of curious habit, throwing long upright branches which bend over when bearing a crop, making the tree like a Weeping Willow. The fruit, when ripe, in November, has a pretty red blush and looks very attractive; but it has no quality whatever, and is only fit for stewing (fig. 353).

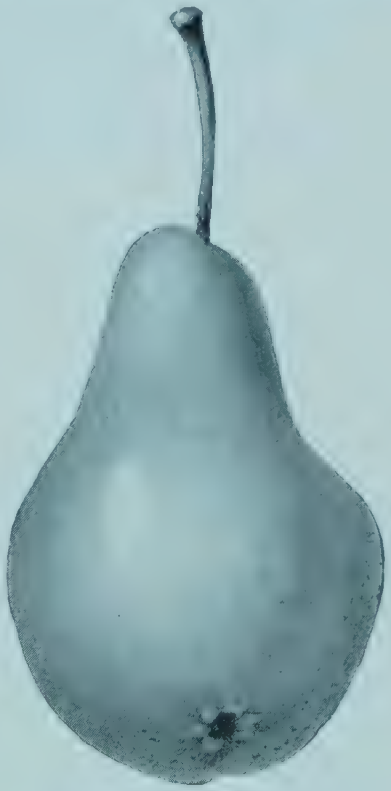


Fig. 353.—Pear. Windsor. (½.)

The above are all for planting on the Pear stock; for the Quince stock there is a much wider range of varieties for the specialist, but only a few can yet be termed market pears.

Clapp's Favourite.—A Pear of American origin, large, well-shaped, with red streaks on one side, with flavour something like the old "Williams' Bon Chrétien", but less distinct; a good bearer on the Quince, but wants planting with caution, the favour with which it was at first received on the market seems declining. Its season is early September.

Dr. Jules Guyot.—Another Pear resembling "Williams' Bon Chrétien" both in appearance and flavour. It makes a regular bush on the Quince, and the fruit is large and handsome, but it remains to be seen whether it will be a market favourite, as the appearance gives a promise of quality which tasting disappoints.

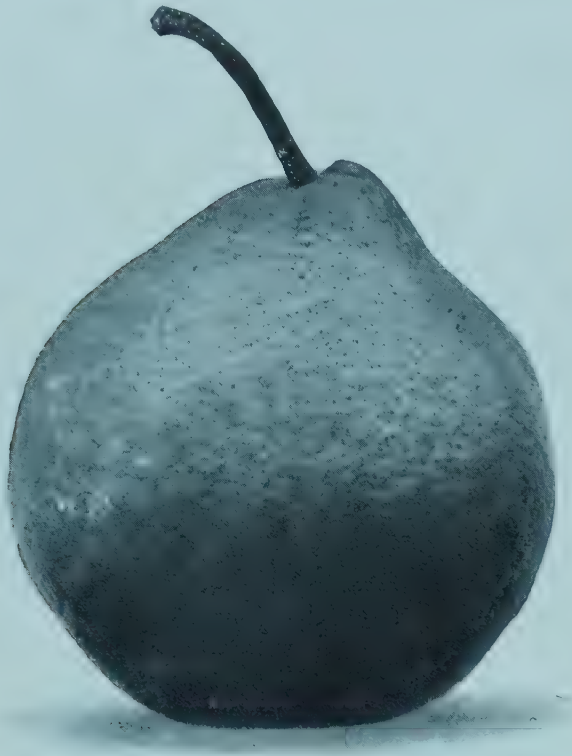


Fig. 354.—Pear. Catillac. (½.)

Beurré Gifford. — A short, spotted, August Pear. The tree on the Quince is of ragged habit, but a good bearer. It can hardly be said to have made a name on the market yet; but it is a promising Pear and worth trying.

Conference.—This is one of Mr. Rivers' introductions, and is a valuable Pear. The fruit is of the elongated russet type; the flesh when ripe has a slight pinky tint; it sells well on the market. The tree on the Quince makes a regular bush and is a good bearer.

Catillac (fig. 354).—For a stewing variety this is one of the best. It grows to a great size; needs keeping till Christmas, but keeps well. Fruit very large, flatly top-shaped, at first pale green, becoming a beautiful bright lemon yellow, tinged with brownish red next the sun, and thickly studded with large brown russety dots.

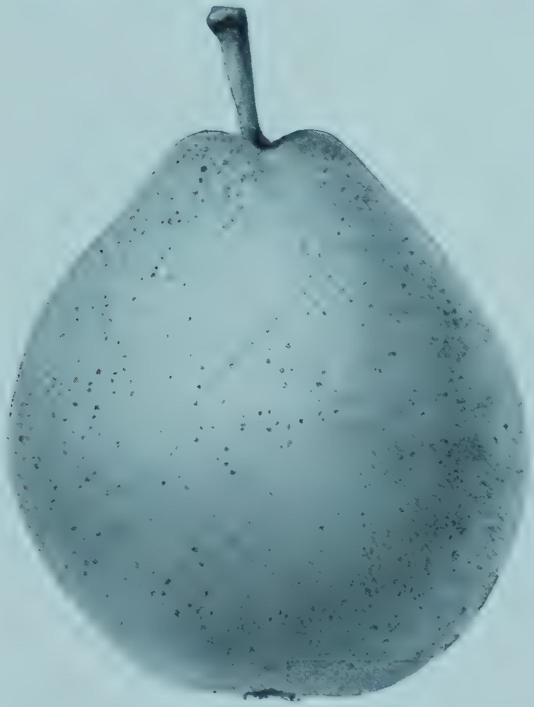


Fig. 355.—Pear. Doyenne du Comice. (½.)

Doyenne du Comice.—This is perhaps for quality the best of all market pears. In Covent Garden it has been named "Angel's Food". Its season is November. Though not a profuse bearer, this variety ought to find a place in the list, if the land will carry Pears at all (fig. 355). [W. G. L.]

Other good market-garden Pears are:—

Beurré Clairgeau.—A handsome and showy pear, probably more suitable for stewing than dessert; in use during November. Fruit large, oblong obovoid, curved, smooth and shining lemon yellow, tinged with orange red next the sun, and heavily dotted and patched with thin russet, especially near the stalk. A very vigorous grower and great bearer.

Beurré Diel.—A delicious pear, ripe in October and November. Fruit large obovoid, pale green at first, changing to yellow, dotted and marked with russet, succeeds best on the Quince stock as a bush. Against a wall it produces excellent fruit of the largest size.

Beurré Hardy.—A fine highly perfumed pear, ripe in October. Fruit large and even, oblong-obovoid, shining yellowish green, thickly dotted with russet, and coated with brown round the stout fleshy stalk and large open eye. Bears heavy crops most seasons.

Beurré Superfin.—One of the most delicious and juicy pears, ripe in September and October. Fruit above medium size, obovoid or top-shaped, somewhat uneven in outline, greenish yellow, becoming lemon yellow with maturity, and covered with thin patches and veins of cinnamon russet. The tree is not a large grower, but bears abundantly.

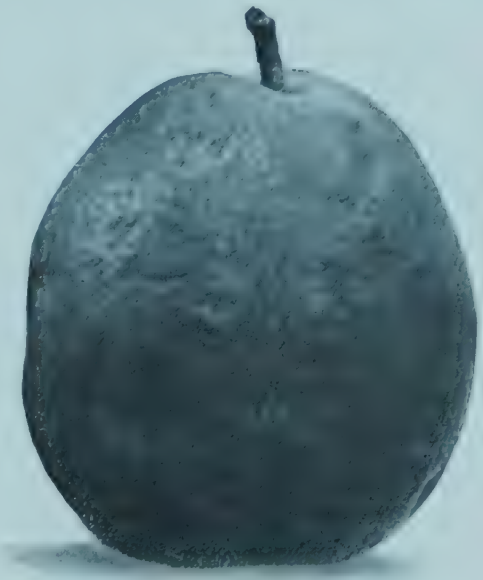


Fig. 356.—Pear. Easter Beurré. (½.)

Easter Beurré (fig. 356).—An excellent variety of high quality in warm rich soils and sunny situations. Fruit large, obovate, yellowish with russet, buttery, and richly aromatic. In season from January to March.

General Todleben.—A fine distinct culinary variety when fully matured. Tree of medium strength, but prolific on the Quince. Fruit very large, long, and pyriform, yellow with russet, sweet, and with a pleasant aroma. In season from December to February.

Glou Morceau.—A rich and delicious pear, in use from December to January. Fruit above medium size, obovoid, smooth, and somewhat irregular, yellowish with a little russet, and dotted (fig. 357).

Louise Bonne of Jersey.—A handsome juicy pear, ripe in October. Fruit medium, oblong obovoid, smooth, yellow on the shaded side, but crimson next the sun, dotted with crimson. In good seasons produces exceptionally fine crops.

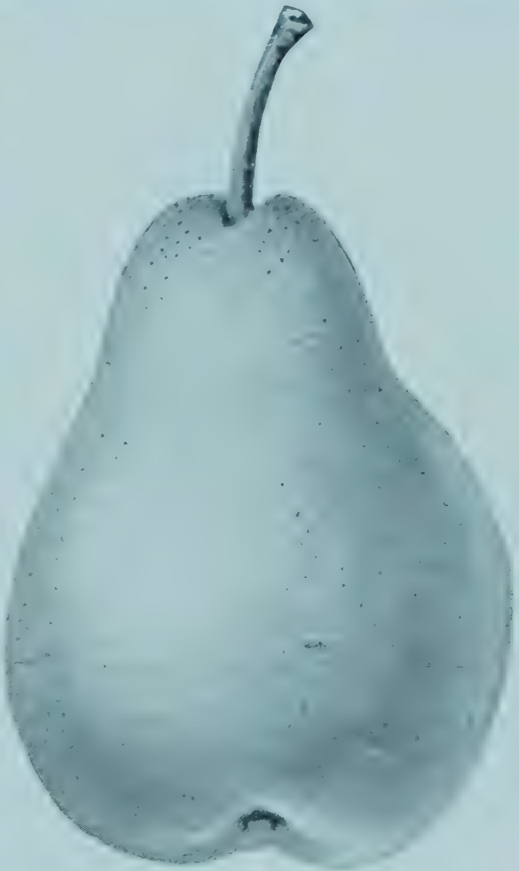


Fig. 357.—Pear. Glou Morceau. (½.)

Beurré d'Amanlis.—A very prolific useful and early variety. Fruit large, pyriform, green and reddish brown. Juicy, sweet, and perfumed. In season in September.

Marguerite Marillat (fig. 358).—A variety of considerable merit; prolific and hardy. Fruit large pyriform, even, brightly coloured, and richly aromatic. In season in September. Grown largely in Jersey.

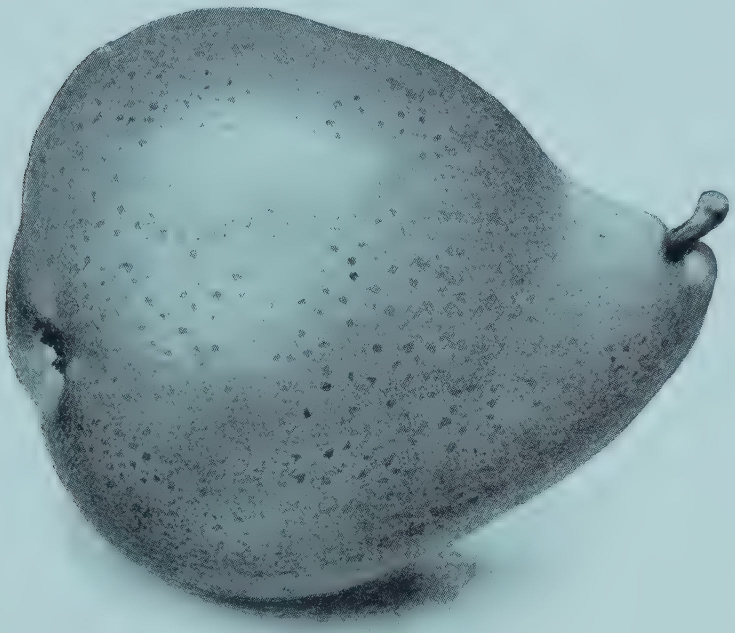


Fig. 358.—Pear. Marguerite Marillat. (½.)

Marie Louise d'Uccle.—A juicy and richly flavoured pear, ripe in the middle of October. Fruit rather large and handsome, obovoid, coated with pale cinnamon russet. Although not so fine as the old "Marie Louise", it is a superior cropper.

Doyenne Boussoch.—A handsome pear, ripe in October, but should be picked early. Fruit very large, roundish obovoid, lemon yellow, covered with large, rough, russety dots; more highly flavoured fruits in southern parts of the kingdom.

Marie Louise.—One of the finest and most richly flavoured pears, ripe in October and November. Fruit large, oblong obovoid, smooth, pale green, becoming yellow with maturity, and marked with thin brown russet. The tree is hardy and free growing, and when grown against a wall produces one of the finest pears known.

Souvenir du Congrès.—An excellent, highly perfumed pear, ripe from the end of August and during September, and somewhat resembling 'Williams' Bon Chrétien", from which it is a seedling. Fruit large, oblong obovoid, wavy in outline, thickly covered with smooth cinnamon-brown russet, with here and there patches of yellow, and streaks of bright crimson flushed with brown on the sunny side.

Fondante d'Automne.—A deliciously juicy pear, ripe in September and October. Fruit large, obovoid, lemon yellow tinged with green, and flaked with pale-brown russet. An excellent variety on Pear or Quince stock, and suitable for market gardens and orchards in southern localities.

Citron des Carmes (or **Madeleine**).—A valuable early pear, ripe in July and August in the south. Fruits small to medium, roundish or obovoid, yellowish, sugary. Tree hardy and prolific.

St. Swithins.—An early pear, ripe in July and early August. Fruit below medium size, obovoid, grass green, dotted and mottled with russet, faintly flushed on sunny side. Tender, juicy, and sweet, but not always fine-flavoured.

§ 3. INSECT PESTS AND DISEASES

Slugworm of Pear and Cherry (*Eriocampa limacina*).—The repulsive slug-like larvæ are frequently seen on the foliage of Pear and Cherry. They are bottle green in colour and covered with a slimy matter above. beneath they are paler, and the anterior region of the body is swollen, the head being more or less sunk into it. They have six jointed legs in front and seven pairs of sucker feet, and when mature change to dry-skinned yellowish larvæ. Their final stage reaches $\frac{1}{2}$ in. in length. The Slugworms feed upon the upper side of the leaves, but leave the under epidermis intact, thus skeletonizing the foliage. When mature, the larvæ fall to the ground and pupate in earthen cocoons.

The female Sawfly is black and about $\frac{1}{2}$ in. across the wings: the first larvæ appear early in June. There may be three broods, and larvæ have been found as late as the end of October. The winter is passed in the soil in the larval stage in a cocoon of silk and earth. When they occur in numbers early in the season they do most harm, but even when late they may destroy so much foliage that the ripening of the wood is checked.

Treatment.—Treatment is best carried out by spraying the trees with arsenate of lead. Dusting with fine lime has also met with success. In gardens the surface soil may be removed to a depth of 3 in., and burnt, in winter.

The Pear-leaf Blister Moth (*Cemiostoma scitella*).—The larvæ of this small moth form circular brown blisters on Pear and sometimes Apple leaves. The moth appears at the end of April and May, and again in July and August. The moth has leaden-grey forewings with a brown streak running from the costa obliquely across the wing; also two white streaks run from the costa nearer the tip separated by a coppery band; beneath these a black spot with a violet pupil, fringe dingy with four dark radiating lines. Wing expanse $\frac{1}{4}$ in.

The larvæ, after mining the leaves, crawl out and spin a white cocoon in crevices on the tree and in the soil, in which they pupate.

Pear Midge (*Diplosis pyrivora*).—This small fly, which belongs to the family Cecidomyiadæ, causes very great loss by its maggots destroying the young pears. Although it has been known for many years it has increased enormously of late, and in some parts of Britain the greater part of the crop is destroyed by it.

The damage is done by the small white maggots feeding inside the young pears. The infested fruitlets are very marked, they become abnormally swollen and deformed and make rapid growth compared with sound fruitlets. The infested fruitlets (known as "bottlers" in the trade) are found to be black inside when cut open and to contain as many as fifty maggots, which when mature reach $\frac{1}{7}$ in. long (fig. 359).

The adult fly appears when the Pear blossom just shows the "white cap stage". The female is only $\frac{1}{8}$ in. long, the male $\frac{1}{10}$ in.; the latter is a dark blackish-grey, two-winged midge with yellow hairs on the thorax. The wings have few veins and are dusky with fine black hairs, the halteres yellow. The female has a long ovipositor, by means of which she lays her ova deep in the unopened blossoms.

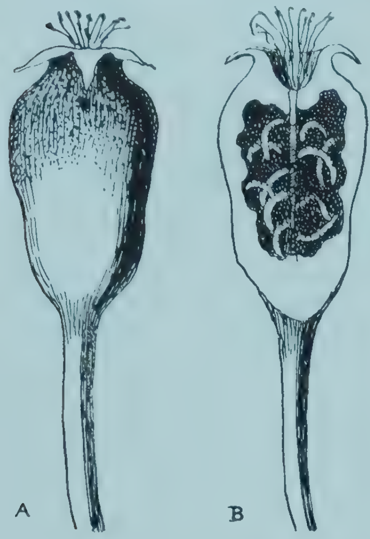


Fig. 359. Young Pear Fruits attacked by Maggots of the Pear Midge

A, Fruitlet "bottled". B, Section of fruitlet, showing white maggots within.

The mature maggots either fall from the fruitlets, which may crack, or the fruitlets may fall to the ground and decay—in either case the larvæ enter the soil and pupate there, remaining beneath the trees until the following spring, at a depth of 1 to 2½ in.

Prevention.—All infested fruitlets should be picked off in May or early June, and destroyed with the maggots in them. Surface soil may be removed in winter to a depth of 3 in. and burnt or buried, or replaced by fresh soil. Spraying has no effect on this fruit pest. The use of the hoe during the summer months would expose the chrysalides to the birds.

The Pear-leaf Blister Mite (*Eriophyes pyri*).—This acarus is related to the mite causing the Big Bud in the Black Currants, but it lives in a different way.

The mite is the cause of the numerous pale blister-like galls one frequently sees on Pear leaves. These leaf galls are each caused by a single minute Eriophyes which enters the leaf by the stomata or breathing pores. In the soft leaf tissue they breed, and as the tissue becomes destroyed they spread farther and farther over the leaves and branches. The galls turn black later, and the whole leaf may die or more usually falls off. Young fruitlets are also attacked and ruined by small reddish blister-like galls being formed on them.

The acari all winter under the bud scales, and as soon as the buds commence to burst get out on to the leaves or blossoms and enter the tissue. For many years this mite did little harm, as it increased so slowly, but recently it has spread in some places with great rapidity, and has done much damage.

Treatment consists of late winter spraying with the following: Quicklime, 6 lb.; sulphur, 3 lb.; salt, 3 lb. Mix these together and enough water to slake the lime. Whilst still hot add more water and boil for forty-five minutes, then add sufficient water to make up to 10 gall.

Another wash is made by adding to the above 1 lb. of caustic soda. The soda and lime are mixed together and slaked in hot water in which the sulphur has been incorporated. This requires no boiling. If the pest continues it is necessary to summer spray with paraffin jelly.

Other Pear Pests.—The Wood Leopard (*Zeuzera pyrina*), Goat Moth (*Cossus ligniperda*), Lackey Moth (*Clisiocampa neustria*), Vapourer Moth (*Orgyia antiqua*), Winter Moth (*Cheimatobia brumata*), Mottled Winter

Moth (*Hybernia defoliaria*), Codlin Moth (*Carpocapsa pomonella*), Fruit Bark Beetle (*Scolytus rugulosus*), Apple-blossom Weevil (*Anthonomus pomorum*), Red-legged Weevil (*Otiorhynchus tenebricosus*), Leaf Weevils (*Phyllobius sp.*), Social Pear Sawfly (*Pamphilus flaviventris*), Apple Sawfly (*Hoplocampa testudinea*), Pear-leaf-curling Midge (*Cecidomyia pyri*), Woolly Aphis (*Schizoneura lanigera*), Apple Aphis (*Aphis mali*), Pear Aphides (*Aphis pyri* and *A. pyraria*), Mussel Scale (*Lepidosaphaes ulmi*), Pear Psylla (*Psylla simulans*), Pear Thrips (*Euthrips pyri*), Pear Oyster Scale (*Diaspis ostreæformis*). (See Vol. I, pp. 186, 187.) [F. V. T.]

Pear Scab (*Venturia pirina*).—The account given under "Apple Scab" applies to Pear Scab, so far as the general appearance of the fungus and preventive methods are concerned. When the fruit is scabbed, deep, gaping cracks usually appear, whereas such cracks are not frequent on Apples. The same disease attacks the Crab, Hawthorn, and cultivated forms of Cotoneaster, from whence the disease may be conveyed to cultivated Apple and Pear trees. (See p. 84.) [G. M.]

QUINCES

The Quince (*Cydonia vulgaris*), although often met with as an ornamental tree, is little grown as a fruit crop, a few specimens being found here and there in the older market gardens. The trees come into flower at the end of April and early in May, and are pale pink to whitish in colour (fig. 360), being followed in autumn by large highly-scented fruits of a somewhat astringent flavour, valued by some for making preserves, for flavouring, &c. As a stock for Pears the Quince is very valuable, and is raised in large numbers for this purpose from layers, cuttings, and seeds. When grown for its fruit the Quince should be planted in a warm sandy loam, about 15 ft. apart. Little pruning will be necessary, and from 2 to 4 bus. of fruit may be regarded as a fair average crop. The best kinds are the *Apple-shaped*, with golden-yellow fruits, roundish; the *Pear-shaped*, the best known, with pear-shaped fruits of a greenish yellow; and the *Portugal Quince*, with larger fruits than the others, but not so free in cropping. The fruits should be allowed to remain on the trees as long as possible—into November—and care should be taken in gathering as they bruise easily.

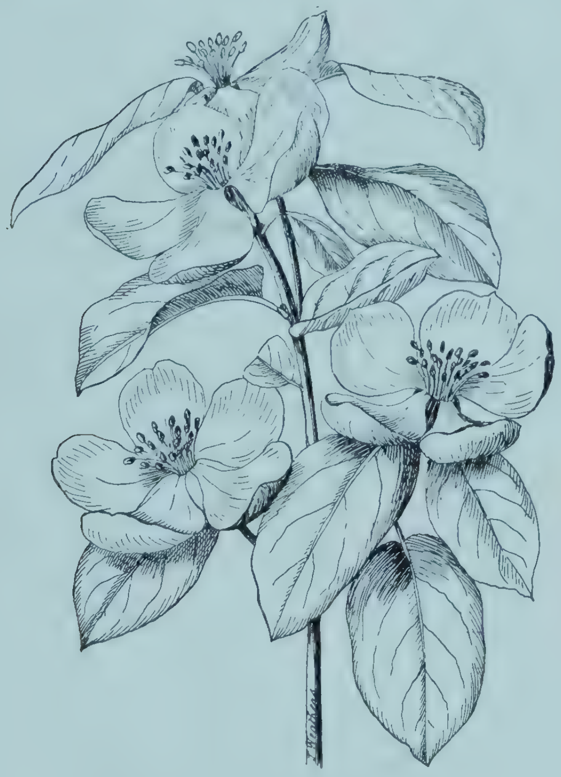


Fig. 360.—Pear-shaped Quince in flower

MEDLARS

The Medlar (*Mespilus germanica*) is more of an ornamental than a fruit tree, but its fruits sometimes find their way to market. It flourishes in any good garden soil of a rich loamy character, and the plants are usually raised by grafting or budding on stocks of the Quince, Pear, Whitethorn, or seedling Medlar, the first two named being preferred. The best varieties are the *Dutch* or *Broad-leaved*, the *Nottingham*, the *Stoneless*, which has no seeds, and the *Royal*. The fruits are allowed to remain on the trees until they have been frosted a few times, after which they become soft and are fit to be eaten, or made into preserves when they begin to decay. If stored, they should be looked over occasionally and diseased fruit should be removed (fig. 360*a*).

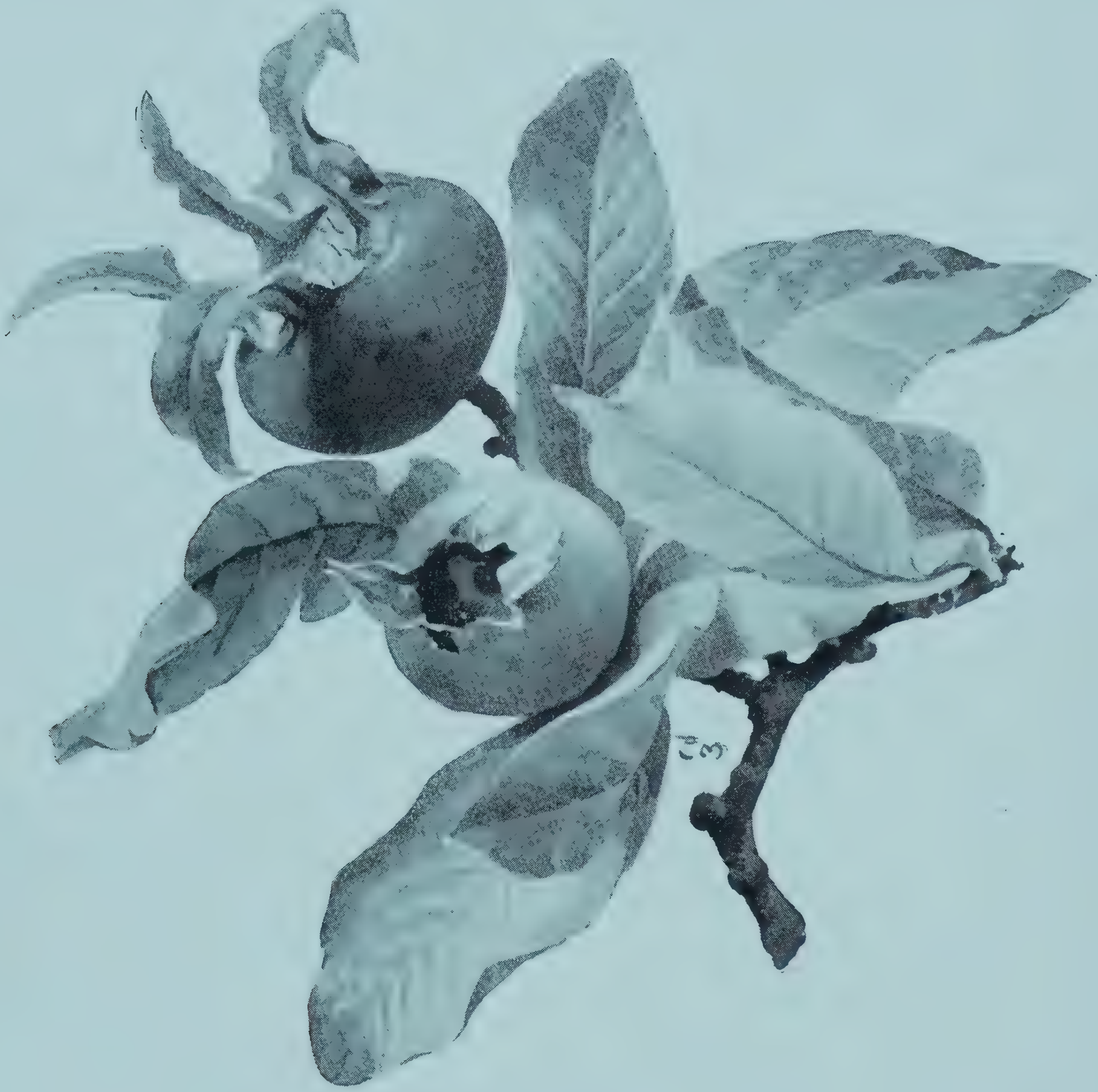


Fig. 360*a*.—Medlar in Fruit

SECTION XXII

Stone Fruits: Plums, Cherries, Peaches, Nectarines, Apricots

PLUMS

§ 1. GENERAL

Next to the Apple the Plum is the most important fruit crop in the British Islands. According to the most recent returns of the Board of Agriculture (1911) about 17,000 ac. are devoted to the industry. Of these there are 16,418 ac. in England alone, Scotland having 291 ac., Ireland about 220 ac., and Wales 77 ac. The largest plum-growing counties in England are Worcester with 3815 ac., Kent with 3269 ac., Cambridge with 1577 ac., Gloucester with 1141 ac., Middlesex with 691 ac., and Bucks with 570 ac. Reckoning fairly close planting at 250 trees to the acre, this would give something like 4¼ million Plum trees for the United Kingdom. Taking the average crop of 2 bus. of plums per tree, 500 bus. would be the crop for 1 ac.; and at 6*s*. per bushel this gives £150 per acre. This figure is probably never reached in practice, but Mr. Bunyard in his *Fruit Farming for Profit* gives £112 as the gross return for 1 ac. of standard Plums yielding 7 tons. This works out at about 9*s*. per bushel of 60 lb., or £16 per ton (each bushel holding about 1000 fruits), and only gives an average yield of a little over 1 bus. to each tree at 250 to the acre. When a larger number than this is planted to the acre, the average yield per tree is of course lower in proportion. Taking good and bad seasons together the gross returns for 1 ac. of Plums may be taken at from £60 to £80, out of which rent, rates, taxes, labour, marketing, &c., must be paid. It must be remembered, however, that one or two severe frosts in April or May will reduce the Plum crop almost to nothing in some seasons. [J. W.]

The attention which of late years has been given to the Plum has made it a much more valuable article to the market grower than it was formerly. To begin with, the season has been materially lengthened by the introduction of new varieties, and many of the old shy-bearing varieties have been displaced by introductions that are good croppers. The increase in the popular use of jam has added another factor to the utility of the Plum. Soils that will grow Apples and Pears will grow Plums. On the lighter warmer soils they will come earlier than on heavy ones; but in dry seasons the latter will bring their fruit to normal size when the former will not. Plums readily show the advantage of leaving the wood uncut when planted. After being pruned during the first winter from planting they will throw up strong shoots that, properly treated, will make a good foundation for the future tree. The shoots require cutting back each year, for four years, to one-third the growth, making the cut just above an outside bud; afterwards they may be allowed to grow, only dead or broken branches and cross pieces that rub against others to be taken out. Some heavy-bearing varieties will prune themselves with broken boughs every third or fourth year. If Plums are planted in alternate rows with Apples or Pears they should be 18 ft. by 15 ft. apart. If planted by themselves, the distance can be decreased to 15 ft. by 12 ft. for some sorts, such as Czar.

The preparations for planting, and the remarks as to under-cropping made in reference to Apples and Pears, will apply to Plums also. Half-standard is the best style in which to plant Plums. Let not the planter be tempted to buy old trees because they are larger; two years is quite old enough.

Plum Stocks.—There are several stocks (the commonest of which stocks are the "Mussel" and the "Brussel" Plum) upon which Plums are grafted or budded, and experience has shown the nurseryman which stock to use, for some varieties of Plum do best on one stock and some on another; it is therefore desirable to buy from one with a reputation to maintain.

Plums are very apt to throw suckers from the roots; these should be carefully taken away before they get large, with a suckering iron or mattock, and care must be taken not to injure the roots. It need not be pointed out that suckers, if left to grow, will, as their name implies, suck vitality from the tree.

The grower will be disappointed to discover that very few, if any, of the market varieties of plums are included in the Royal Horticultural Society list of dessert plums, but it will console him to reflect that it is for him to cater for the multitude, who may be able to appreciate, even for dessert, plums which the fastidious patrons of the Royal Horticultural Society would class as cooking plums. The rule seems to be, if a Plum bears with vulgar frequency, class it as a cooker; if in its esoteric superiority it bears but now and then, dignify it with the title of dessert.

The object of the market grower in selecting his Plums is to get as long a season as possible without getting too many varieties in at the same time; and it goes without saying that he requires sure croppers.

The "Victoria" has so captured popular favour that it is wellnigh impossible to get any other plum justice during its season, albeit the other plum may be much superior in quality. [W. G. L.]

§ 2. VARIETIES OF PLUM TO PLANT

Rivers's Early Prolific.—This is a most valuable Plum where it will crop. At Sawbridgeworth, where it was raised, it seems to crop regularly. It is early—coming in at the end of July—and though small is of good quality and readily finds a market where plums will sell at all. On suitable soil, which would seem to be a rich strong loam, it makes a handsome tree (fig. 361).

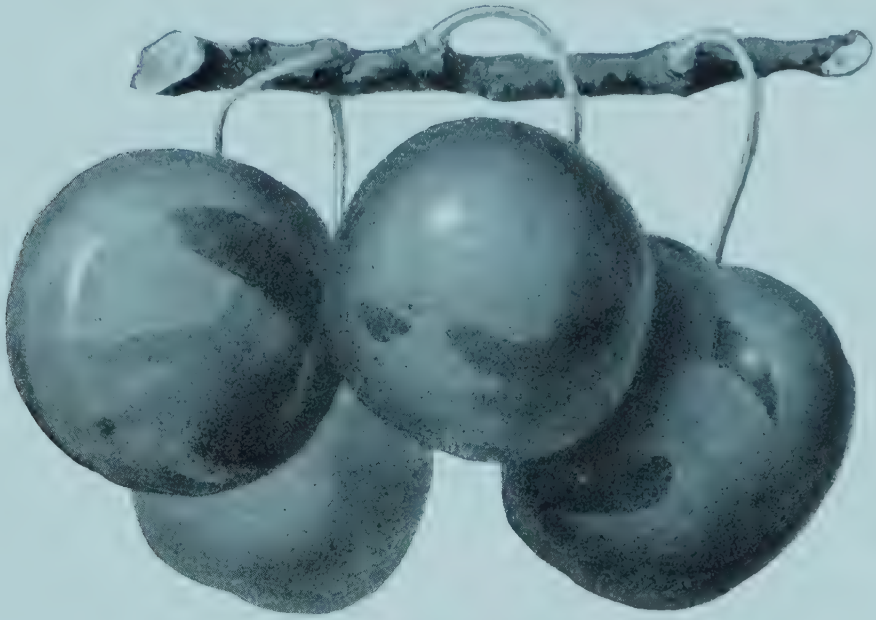


Fig. 361.—Plums. Early Prolific (Rivers'). Nat. size

The Czar.—Another Plum raised by the late Mr. Rivers. One of the surest croppers, upright in growth — very susceptible to Aphis attacks. Fruit larger than that of Early Prolific, but of inferior quality, dull red ripening to blackish purple. Season, early August.

Gisborne.—A yellow Plum of inferior quality, below medium size, useful for jam and cooking; a heavy cropper. It can often be gathered green the third week in July. It is always a cheap Plum, but as it flowers very late it sometimes misses the frost that has killed those varieties which flowered earlier.

Pershore. — This is called the Worcester Egg Plum. It is inferior in quality to the Gisborne. Is a very heavy cropper and largely used for jam. The fruit is medium-sized, yellow, tinted with gold.

Heron.—One of Messrs. Rivers's raising, has not been out long enough to get a market character, but has been planted by some growers on the strength of its performances at Sawbridgeworth.

Prince of Wales.—This fine-quality Plum is being discarded by many growers because it has a habit of dying suddenly when apparently in full vigour and without any discoverable reason. Nevertheless it is still useful. It flowers early, and quickly throws a mantle of broad leaves over the young fruitlets. From this cause there is often a better crop of Prince of Wales than of any other Plum; that was the case in Middlesex in 1910. The quality of the fruit is good enough for dessert among ordinary mortals. Fruit roundish oval, bright purple, dotted with yellow.

Belle de Louvain.—A large-sized, reddish-purple, strongly-scented plum. A good bearer and producing a large spreading tree requiring plenty of room. Can be gathered for travelling before Victoria.

Victoria. — Everyone knows this bright-red plum, perhaps the most popular grown. It possesses all the characteristics a good plum should possess, except flavour. For the market grower it pays the best of any. The tree is terribly liable to "Silver Leaf". It occasionally bears so profusely as to require thinning of the fruit; if this is done early in July the plums can be sold for green-plum jam or for bottling. September.

Curlew.—A medium-sized dark plum, perhaps the most delicious cooking plum grown, producing a syrup of peculiarly rich colour. The tree is short-jointed and bushy, like the Damson. A moderate bearer. Season after Victoria.

Pond's Seedling.—This handsome scented Plum (fig. 362) with very large oval dark-red fruits is a very shy bearer in Middlesex, but in Kent and Essex it bears a better character. It always finds a ready sale from its attractive appearance. The tree is upright in habit and attains a height of 40 ft. It is very susceptible to "Silver Leaf". Ripe in mid-September.

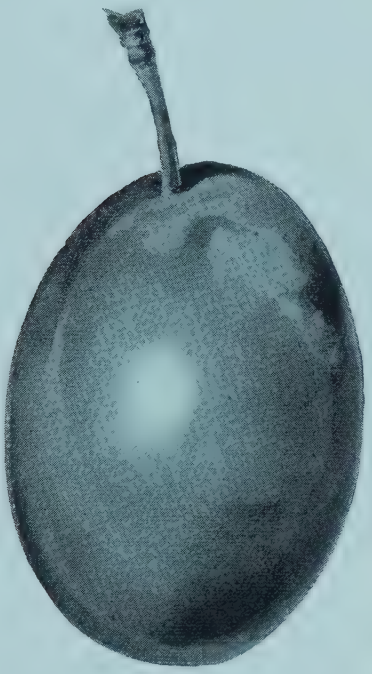


Fig. 362.—Plums. Pond's Seedling. (⅔.)

Kirke's.—A fine dark purple plum fit for picking in August and September.

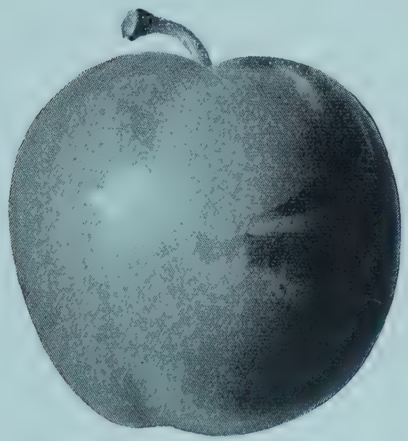


Fig. 363.—Plum. Monarch (Rivers'). (⅔.)

Orleans.—This deep purple-red variety is much grown in places, and may be gathered from mid August. (See coloured plate.)

Belle de Septembre.—As its name implies, a September plum, usually coming in well after Victoria. It is a large roundish-oval violet-red plum of medium quality. The tree is drooping and a good cropper.

Monarch.—One of the best of the introductions of Messrs. Rivers. Comes in the latter end of September. The large blackish-purple fruit is round with pointed nose, of great size, with bloom on the skin. The tree is upright-growing, seldom attacked by Aphis, and fairly able to resist the "Silver Leaf" disease (fig. 363).

Bryanston's Gage.—It requires careful consideration before a market grower plants any of the Gage tribe. Except in special localities most of them are woefully shy bearers. The above is one of fair gage flavour, of attractive appearance, and a good cropper in a warm sheltered position. The same may be said of the old and earlier "Greengage" which has deliciously flavoured fruit of a deep yellowish green dotted with crimson.

[W. G. L.]

§ 3. PLUM PESTS AND DISEASES

The Red Maggot of Plums (*Opadia funebrana*).—One frequently finds a reddish larva in plums and gages when ripe. This is the caterpillar stage of a small moth called the Plum-fruit Moth (*Opadia funebrana*). The moth (fig. 364) appears in June and July. The female lays her eggs at the base of the stalk, and the larvæ on hatching enter the fruitlet. The moth is ½ in. in wing expanse; the front wings are purplish grey, clouded with smoky grey; at the anal angle is an indistinct ocellated patch edged with shiny pale grey and enclosing four black dots. The larvæ feed on the inside of the fruit, especially around the stone. The colour varies from red to chestnut red with yellow sides, and some of the segments have dark spots. In length the larva is about ½ in. When mature they leave the fruit, and many fall to the ground; if so, they reascend the trees until they come to some shelter. The winter is passed in the larval stage under any shelter, mainly on the trees, such as under cord, shreds, rough bark, &c., in a cocoon very similar to that of the Codlin Moth. In spring they pupate in this cocoon.

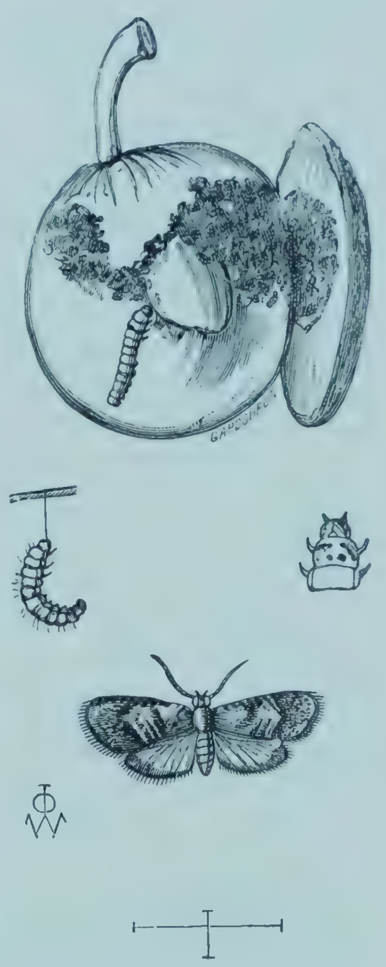


Fig. 364.—Plum Grub and Moth (*Opadia* (*Carpocapsa*) *funebrana*)

Treatment and Prevention.—There is no method of destroying the creatures when once inside the fruit, but the larvæ may be trapped in large numbers by placing pieces of manure sacking around the trees, the same as is recommended for Codlin Moth. The bands may be removed and burnt in winter with the hibernating larvæ and cocoons caught up in the sacking.

The Plum-fruit Sawfly (*Hoplocampa fulvicornis*).—Plum fruitlets are often attacked by the larvæ of a sawfly in the same manner as the Apple. The infested fruitlets have small holes in them, and so can readily be seen. As long as the maggot is present in the fruitlet this hole is blocked up with wet brown frass. The larvæ move from one fruitlet to another, and must damage a good many during their period of growth. All manner of plums, gages, and damsons are attacked when quite small. The adult Sawfly appears in April and May. The female is shiny black with yellowish-red legs, and iridescent wings, and is rather more than $\frac{1}{3}$ in. in length. The female lays her eggs in the unopened blossoms. These hatch in a few days, and the young Sawfly larvæ force their way into the embryo fruit and feed on the developing kernel. The larva inside the plum can at once be told by the number of its legs, there being six jointed legs and six pairs of prolegs and an anal pair. The colour is creamy white, but some have a pinkish tinge, and when full grown reach $\frac{1}{3}$ in. in length. When mature they enter the soil and form a cocoon of earth, in which they remain as larvæ until the following spring.

PREVENTION.—As this pest usually seems to start on a single tree, it is well to have all infested fruit on the tree hand-picked before the insect has time to spread. The only other time we can deal with it is when the larvæ enter the soil. Probably then a good dressing of vaporite worked into the soil would destroy many of the larvæ before they had spun their cocoons. (See Vol. I, p. 189.)

The Leaf-curling Plum Aphis (*Aphis pruni*).—The curling of Plum leaves by Aphis is often very severe, and causes the leaves to fall prematurely. The green Aphides which cause this disease are found protected in the curled leaves, where they produce living young with great rapidity. They are the progeny of a dull plum-coloured mother queen Aphis which hatches out before the buds burst, and which may be found, long before there is any sign of leaf or blossom, seated in the axils of the buds. This fat female produces green living young which curl up the leaves. In June this Aphis becomes winged and leaves the Plum; where it goes to we do not know. It returns to the Plums in autumn and produces a sexual brood, the oviparous females laying eggs in and around the bud cluster, where they remain until the next February or March.

TREATMENT.—Treatment consists of early spraying with soft soap and quassia before the leaves become badly curled. Winter spraying in February with thick lime-and-salt wash will stop many of the ova from hatching out, and would destroy any of the plum-coloured mother queens.

The Mealy Plum Aphis (*Hyalopterus pruni*).—This Aphis forms a mealy mass under the Plum leaves but does not curl them up. This Mealy Aphis appears on the Plums in June and July. It comes from rushes and reeds, being the same as *Hyalopterus arundinis*, which feeds on those plants. They form much honey dew, which falls on the fruit and which becomes covered with the black soot fungus, and so ruins the fruit for market. In early autumn this Aphis flies back to the rushes and reeds.

It cannot be killed with soft soap and quassia nor paraffin emulsion, but if 1 lb. of liver of sulphur is added to every 100 gal. of the paraffin emulsion they are easily destroyed.

The Shot-hole Borer (*Xyleborus dispar*).—The Shot-hole Borer is a small beetle about $\frac{1}{8}$ in. long, of a dark-brown to black colour, with reddish-brown wing cases. The female commences her attack by boring into the main stem of fruit trees, but also into the branches. The beetles hatch out in May and June, and lay their eggs in tunnels in the wood. The small white maggots partly fill up the tunnels, being packed close together in a line. The maggots feed on a grey-and-black substance lining the galleries, called "ambrosia". One female will lay as many as forty ova at different times in June. They pupate in the galleries close together, and when the beetles hatch out they are found packed together like shot. The beetles are found in January, February, May, September, on to December in the galleries, but flight time occurs mainly in May and June and in August and September. All badly attacked trees should be cut down and burnt in winter.

Other Plum Pests.—Winter Moth (*Cheimatobia brumata*), Mottled Umber Moth (*Hybernia defoliaria*), Early Moth (*H. rupicapraria*), March Moth (*Anisopteryx æscularia*), Figure-of-8 Moth (*Diloba cæruleocephala*), Goat Moth (*Cossus ligniperda*), Wood Leopard (*Zeuzera pyrina*), Vapourer Moth (*Orgyia antiqua*), Plum Tortrix (*Penthina pruniana*), Allied Bud Moth (*P. variegana*), Codlin Moth (*Carpocapsa pomonella*), Red-legged and Clay-coloured Weevils (*Otiorhynchus tenebricosus* and *O. picipes*), Leaf Weevils (*Phyllobius sp.*), Plum-leaf Sawfly (*Cladius padi*), Slug-worm (*Eriocampa limacina*), Social Pear Sawfly (*Pamphilus flaviventris*), Hop Damson Aphis (*Phorodon humuli*, var. *malaheb*), Oyster-shell Bark Louse (*Aspidiotus ostreæformis*), Mussel Scale (*Lepidosaphes ulmi*), Brown Scale (*Lecanium capreæ*), Leaf Hoppers (*Typhlocybidæ*), Plum-leaf Gall Mites (*Eriophyes padi, &c.*), Red Spider (*Tetranychius telarius*).

[F. V. T.]

Silver Leaf.—The Plum has diseases peculiar to itself, as well as sharing in others common to the Apple and the Pear. The worst of all is what is called "Silver Leaf", from the peculiar sheen on the foliage which is the first evidence to the eye that the tree is smitten. The disease, which seems to have been first mentioned in Mr. J. Weathers' *Practical Guide to Garden Plants*, published in 1901, attacks Apples sometimes, but not Pears; in Plums it has become so serious as to threaten with extinction the cultivation of the "Victoria" in some parts. So far, no authoritative statement has been made as to what is a remedy for it, although it has been proved to be due to a fungus called *Stereum purpureum*.

In *The Fruit Garden* the disease is not even mentioned, and yet it is responsible for the death of thousands of Plum trees every year. In one mixed plantation in Middlesex, out of a quarter containing 8 ac. of Victoria Plums and Apples, over 300 trees were thrown up in the winter of 1909–10. These trees were fifteen years old, and therefore just in their prime. The disease is not confined to any one part of the country, and a drive in any district where Plums are cultivated will show the patches of silvered foliage which tell that the tree is doomed, and each year it extends its ravages. Some varieties of Plums seem more susceptible than others; the "Victoria" and "Prince of Wales" appear to be the worst, but none are immune.

Cultivation seems to make little difference; it can be seen where the work is done properly, the trees watched and attended to, and the land kept clean, as well as where nothing is done to the trees, and the weeds are allowed to cheat the labourer of his hire. In fruit gardens and grass orchards it is all the same. Rumours are sometimes current that someone has found a remedy, but up to now it has failed to crystallize. Once it was the insertion of sulphate of iron to the trunk and branches of the tree by boring holes 1¼ in. diameter and plugging them with Portland cement, which had cured all the diseased trees on one plantation; next, it was the application of 3 lb. sulphate of iron to the roots by forking it in, repeated each winter for three years, that had worked the cure. Probably we shall hear more of the effect of the above and other methods of treatment, for many are trying them. It seems to be generally agreed that the application of lime and sulphate of iron is in the track of a remedy. But how much of each, and how to apply them? Does the composition of the soil make any difference to the amount or proportion of each required, and are other ingredients likely to be needed in some soils? All these and many other questions can only be answered by careful and exhaustive experiments, scientifically arranged and managed and carried over a series of years. Who is to do it? Where is the Government experimental farm, or, better still, where is the agriculturists' joint experimental farm? The market grower, whatever scientific training he may have, however much he may desire to obtain accurate data, is ill qualified to carry out such experiments. His business is to obtain by the cultivation of the soil a profit upon his outlay and an earning for his labour of brain and muscle which shall afford him the means of a livelihood. In this pursuit there come things that must be done at a certain time, and at the same time some investigation in connection with the experiment must be made or some data noted, and it is the latter that has to go, so the detachment and continual attention necessary to obtain reliable data from the experiment cannot be given.

If the Board of Agriculture ever were desirous of doing something in this line, a plan more effective and immensely less expensive than the establishment of one experimental farm might be adopted. That is, stations for experiment might be established on farms in different counties by arrangement with the cultivators, who would do the work, as directed, for agreed payment, and the data noted by scientists who would pay regular visits for that purpose. The advantages gained would be that the experiments, being spread over several counties instead of being confined to one spot (the experience gained at which could never be held to apply to the whole kingdom), would be brought under the eyes of growers, who would take more interest in them and learn more from them than they would from what is done at an experimental farm which many of them would never be able to visit, and the literature of which they might never read; finally, the saving of expense.

As things are, the grower must make what experiments he can. He will find, as has been said, the use of lime, sulphate of iron, and also sulphate of potash useful. The disease is said to be highly contagious, able to transfer itself from tree to tree by means of spores carried on the wind when liberated from the decaying wood it has killed. To make sure, all wood cut from affected trees should be quickly burned, and the saw or knife, after cutting on an affected tree, should be dipped in some antiseptic fluid before being used on another tree. When a tree is badly diseased the only thing known at present to do is to root it up. Before planting another, the hole should be broken up deeply and 3 lb. of sulphate of iron sown over it, and a day or so after 15 lb. freshly slaked lime. [W. G. L.]

This disease, Silver Leaf, is much in evidence at the present day, both at home and in countries as far distant as New Zealand. The symptoms are a change from the normal green colour of the leaves to a dull lead or silvery tint. During the first season of attack usually only a few branches here and there show the disease; the second year, as a rule, all the leaves on the tree are attacked, and very frequently during the third year the tree dies outright. It is believed by some that this disease is caused by a fungus called *Stereum purpureum*, and the evidence in support of this belief appears to be so convincing that it has to be admitted that the fungus can cause Silver Leaf. On the other hand, it is more than doubtful as to whether the enormous increase of the disease during recent years in many parts of the world is all due to *Stereum purpureum*, a very common fungus in this country. Why has this fungus only recently attacked Plum trees?

Apart from this question, however, it is important to remember that when a tree is once attacked, as a rule it does not recover, and should be replaced at once by another tree, which does not become diseased through occupying the place of the diseased tree. Not more than a dozen cases are on record where a diseased tree has recovered out of the thousands that have been attacked.

No cure is known. As a preventive measure all *Stereum purpureum*, a fungus forming purplish or lilac crusts on dead branches, should be removed and burned. When old, the fungus becomes bleached and almost white.

Crown Gall. Described under "Loganberry". (See p. 163.)

Gumming. See p. 52. [G. M.]

DAMSONS AND BULLACES

Damson.—This is a kind of small plum, a cultivated form of *Prunus insititia*, from which the Bullace is also derived. It is distinguished by oval and not roundish fruits, of a deep blackish-violet colour, with a heavy bloom when ripe. The trees naturally prefer moist situations, such as near the banks of running streams, &c., and they attain a fairly good age before coming into bearing.

Damsons are often planted round a plantation on the outsides, sometimes actually *as* a hedge. The idea, perhaps, is that from their rough acid flavour, when uncooked, there is less likelihood of the public helping itself. But as they are terribly subject to Aphis attack it is a bad plan, unless the grower makes up his mind to repel the Aphis; if he does not, the whole plantation may be infested from them. A variety named "Damascene" is grown in Worcestershire. Some say it was brought home from Damascus by the Crusaders. Other useful varieties are the "Farleigh Prolific" or "Crittenden", a heavy cropper, but one that some jam makers will not accept as a Damson. The "King of the Damsons" is a spreading tree, with large fruit, borne singly, not in clusters. Very apt to crack if not gathered in time. [W. G. L.]

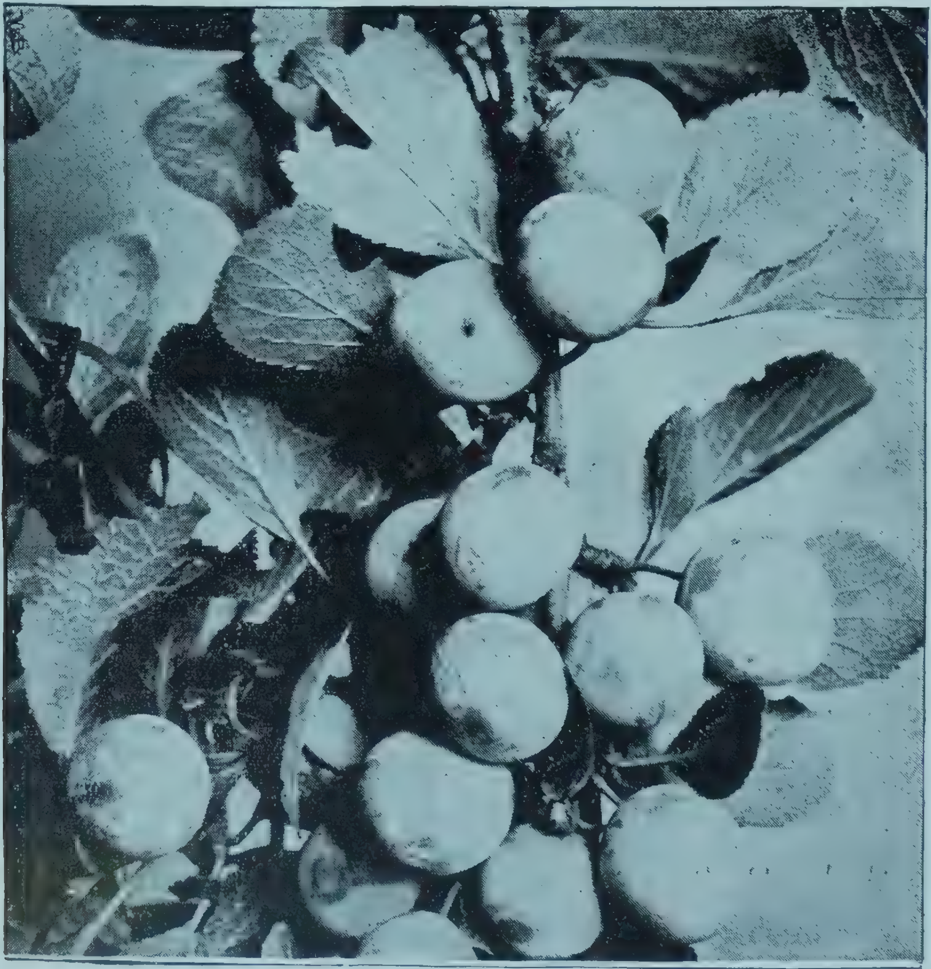


Fig. 365.—White Bullace

Bullace.—The Bullace is a form of the Wild Plum (*Prunus insititia*) found in the hedgerows and copses of Britain. The fruit is larger than that of a Damson or a Sloe, but is smaller than most plums or gages, and is usually roundish in shape. For practical purposes the Bullace is treated merely as a form of the Plum, and when grown at all is treated in the same way. The best variety is probably the "White Bullace" (fig. 365), with yellowish-white fruits mottled with red on the sunny side. It is a very heavy cropper, and is generally in season at the end of October and early November. Other varieties are the "Black Bullace", "Essex Bullace", "Royal Bullace", and "New Large Bullace". [J. W.]

Insect Pests.—Winter Moth (*Cheimatobia brumata*), March Moth (*Anisopteryx æscularia*), Yellow Leaf Hopper (*Chlorita viridula*), Plum-fruit Sawfly (*Hoplocampa fulvicornis*), the Hop Damson Aphis (*Phorodon humuli*, var. *malaheb*).

The Aphis on Damsons may easily be controlled by spraying in February with lime and salt, and later with soft soap and quassia. It leaves the Damsons from the middle of May on to June and flies to the Hops, returning to the Damsons in autumn. [F. V. T.]

CHERRIES

§ 1. GENERAL

The modern Cherry has been evolved from two more or less distinct species of Wild Cherry, both natives of the British Islands, and also found across Europe to the Himalayas. One species—the *Prunus Cerasus* or *Cerasus vulgaris* of botanists—is the Wild or Dwarf Cherry. It grows 15 to 20 ft. high, has reddish bark, slender drooping branches, and dark bluish-green serrated leaves, and clusters of pure-white flowers in May. The Morello, Duke, and Kentish Cherries are considered to have arisen from this. The variety "Bigarella" (or *Cerasus duracina*) is supposed to be the ancestor of the Bigarreau or Bigarron, and Heart Cherries. This distinction, however, is also claimed for the other wild species of Cherry (*Prunus* or *Cerasus Avium*), from which the "Geans" have also been obtained. Following the late Dr. Hogg's classification in the *Fruit Manual*, and quoting from the Editor's *Practical Guide to Garden Plants*, Cherries may be grouped into four principal classes.

1. **Geans.**—These are round-headed trees with long, wavy, thin, and flaccid leaves, and more or less heart-shaped fruits with a tender and melting flesh. According to the colour of the flesh they are divided into (1) *Black Geans* and (2) *Red Geans*. They grow best on the Cherry stock as a rule.

2. **Bigarreaus.**—These resemble the Geans in habit and foliage, but have heart-shaped fruits, which are divided according to colour into (1) *Black Hearts*, and (2) *White* or *Red Hearts*. They grow best on the Cherry stock as a rule.

3. **Dukes.**—The Duke Cherries have upright or spreading branches, with large and broad leaves. According to colour they are called (1) *Black Dukes* and (2) *Red Dukes*. They grow best on the Mahaleb stock as a rule.

4. **Morellos.**—These have long, slender, and drooping branches, with small and narrow leaves. According to colour of the fruits they are known as (1) *Black Morellos* and (2) *Red* or *Kentish Morellos*. They grow best on the Mahaleb stock as a rule.

Acreage under Cherries.—According to the returns of the Board of Agriculture and Fisheries (1911), there are about 12,000 ac. of Cherry land in Great Britain. No figures appear to be available for Ireland, and there are probably no Cherries grown for profit in that country. Only half a dozen acres are recorded for the Channel Islands, mostly in Jersey. Scotland has about 23 ac., and Wales 30, so that England with 11,952 ac. is really the only part of the United Kingdom where Cherries are grown at all on a large scale. Out of these 11,952 ac., 6570—more than half—are in Kent. The next most important Cherry county is Worcester with 1287 ac.

The counties having over 100 ac. of land under Cherries may be tabulated thus:—

Kent ...	... 6570 acres.	Middlesex	... 179 acres.
Worcester	... 1287 "	Norfolk	... 152 "
Bucks	... 692 "	Yorkshire	... 140 "
Hereford	... 410 "	Suffolk	... 135 "
Devon	... 252 "	Cambridge	... 115 "
Cornwall	... 250 "	Essex ...	... 107 "
Hertford	... 229 "	Salop	... 104 "
Berkshire	... 213 "	Oxford	... 103 "
Gloucester	... 210 "	Warwick	... 91 "

There are practically no Cherries grown in Northumberland, only an acre being recorded. From 50 to 90 ac. of Cherries are to be found in the counties of Somerset (88), Notts (76), Lancaster (67), Lincoln (65), Sussex (58), Monmouth (53), Huntingdon (51), and Surrey (50).

In Scotland, Perth is the only county with any Cherry pretensions, 7½ ac. out of a total of 23 for the whole country being recorded. No Cherries at all are apparently grown in twenty counties in Scotland, and the acreage in the others is not worth considering, although about 5 ac. are recorded for Ayrshire. [J. W.]

§ 2. CULTIVATION

The Cherry, which in this country is nearly always grown as a standard, is essentially an orchard tree. It is but rarely seen in gardens, for the reason that it is practically impossible to keep the birds away from the fruit on a few isolated trees, unless these are growing against a wall and can be netted. In the orchard and on a large scale the birds can be checked with the gun.

Standard orchard Cherries are grafted solely upon the wild Cherry stock. For dwarf or walled trees the perfumed or Mahaleb stock is used, since it induces a slower growth.

The Cherry is the largest of the English orchard trees, and on this account a Cherry orchard takes a long time to reach full maturity. As a rule, the trees begin to produce marketable crops about the sixth year. The crop gradually increases each year, until at the age of twenty years the trees are in their prime.

During recent years the methods adopted in the management of Cherry orchards have very materially advanced. New varieties, some more prolific and others of better quality, have been introduced. Diseases, which in former times were unknown, have increased in virulence, become epidemic, and now have to be combated by a variety of methods. Greater attention is being paid to packing and marketing to ensure the arrival of the fruit in good order at the markets and thus obtain the top prices.

The soil most favourable to Cherries is a strong rich loam of considerable depth overlying a subsoil that allows of a free natural drainage. It is often said that Cherries will thrive wherever Elm trees grow well. To a certain extent this is true; there is no better guide to good land than luxuriant Elm trees, but the second condition, good natural drainage, is not always indicated by their presence. Much of the land in the neighbourhood of Sittingbourne and Faversham, a district famous for Cherries, is of the above description—a rich loamy brickearth overlying a chalk subsoil at a depth of from 5 to 10 ft. A good strong loamy soil that is wet, but in other respects suitable, may be adapted to Cherry growing by thoroughly draining the land previous to planting.

One of the best positions in which to plant Cherries is a Hop garden, provided the above-mentioned conditions are obtainable, because not only can a valuable crop of hops be secured from the land whilst the Cherry trees are developing, but the trees will also thrive and grow rapidly under the high state of cultivation and abundant manure normally given to Hop gardens.

In selecting the situation for a Cherry orchard there are three other points to be considered: (1) The ground should not be subject to late frosts or be exposed to severe winds; (2) birds do great damage by eating the ripe cherries, and since birds are always more numerous in a thickly wooded country it is preferable not to plant a Cherry orchard adjoining a large wood; (3) proximity to a railway station is a matter of importance. Cherries, like all soft fruit, deteriorate rapidly; hence proximity to a railway station with a good service of fruit trains is a great advantage.

Planting.—The first consideration with regard to planting is the selection and purchase of trees. It must be remembered that the initial cost of the trees bears a trifling proportion to the other expenses of

Cherry growing; consequently the best trees are always the cheapest in the end. Faulty and second-class trees should not be planted.

In the selection of Cherry trees attention must be paid equally to both root and shoot. The roots should be evenly distributed on all sides, not long and straggling, but numerous, fibrous, and spreading in all directions. The tree should have a straight stem, not less than 5 ft. nor greater than 6 ft. high. The branches should be numerous, evenly balanced, and on no account lopsided.

It is not advisable to buy trees that have been budded at the crown, since these are often badly balanced and have a "gouty" lump where the bud was placed. If worked at the top, the stock should be grafted, not budded, since grafted trees more often form well-balanced heads.

In laying out an orchard, consideration should be given to the time of ripening of the fruit. It is convenient to have all the early sorts on one side, the medium in the centre, and the late sorts on the other side of the orchard. By this means not only can the birds be more easily kept off, but the cherries can also be more economically gathered, with less moving of ladders, &c.

When full grown, a Cherry tree covers a large area of ground—considerably more than other orchard trees; the trees should therefore be planted far enough apart to allow of maximum development. The best distance for this purpose is 2 rods (33 ft.) apart in each direction. This allows 4 perches of ground for each tree, and thus forty trees are required for each acre. It is preferable to plant the orchard upon what is usually called the "diamond" plan (fig. 367) rather than the "square" (fig. 366). In the latter case the trees in each row are planted opposite one another.

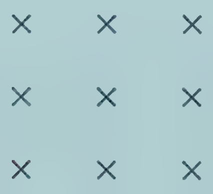


Fig. 366.—Diagram illustrating Square Planting

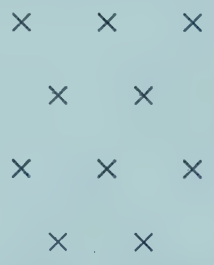


Fig. 367.—Diagram illustrating "Diamond" Method of Planting.

In the former case the trees in one row are planted half-way between the trees in the next row. When planted diamond fashion the boughs of the trees in one row can attain a greater development before they reach those of the next row; thus each tree has a greater air space and gathering is facilitated.

At the present time there are two very different methods adopted for the planting of fruit trees. It must be remembered that the roots of a tree serve two functions: firstly, to support the tree in an upright position, especially against wind; and secondly, to traverse the soil and absorb from it the ingredients of plant food necessary for the growth of the tree. In view of these functions the two methods will be examined.

The method of planting adopted by the ordinary practical fruit grower is to dig out a shallow hole 6 to 9 in. deep and about 3 or 4 ft. in diameter, according to the length of the roots. Any injured roots are then trimmed off with a sharp knife and the small fibrous roots are spread out very carefully with the fingers, and the tree is placed firmly in the centre of the hole. Some fine earth is shovelled on top of the roots and carefully worked in among them. More earth is then shovelled in and gently but firmly trodden down tightly, taking care to bruise the roots as little as possible in the process.

The alternative method, due to the experiments of Mr. S. U. Pickering[1] upon the Duke of Bedford's Experimental Fruit Farm at Woburn, consists in digging out a similar hole; but instead of carefully working the soil in among the roots, as in the former method, the soil, after being shovelled in a little at a time, is rammed down tightly with a heavy rammer, the last shovelful of soil only being put loosely upon the rammed and puddled soil beneath.

Careful experiments have shown that in the former method, even with the greatest care, many of the old roots die, and it is certain that practically all the delicate root tips are destroyed, and it is these root tips alone that serve to absorb plant food from the soil. On the other hand, new roots do not develop freely in the loose soil. Thus in the older method the roots neither absorb much nutriment from the soil nor do they hold the tree securely in the loose soil.

By Pickering's method, on the other hand, the majority of the finer roots are killed at once, but new roots quickly develop in the firm soil, and, as soon as they have grown outside the circle of puddled soil, begin to absorb nutriment to feed the tree. In the firm soil also the roots support the tree more effectually. This method, though apparently so ridiculous to the practical grower, is based upon the most accurate experiments. These have shown that in nearly all cases trees so planted grow much more rapidly than those planted upon orthodox lines.

After the trees have been planted they should be supported for the first few years of their life by being tied to a stake, which is set in the ground close to the tree. Care must be taken to see that the stake does not rub against the bark of the tree. For this reason the stake should be perfectly straight, and should be driven into the ground upon the side of the tree from which the strongest winds come; this is usually the west side. The best method of fixing the tree to the stake is by means of straw bands, which must be renewed at least once a year. If the trees are bound with string, over a padding of sacking, this operation of renewing the bonds is likely to be neglected, and the bark will be injured by the string.

Management of Cherry Orchards.—The management of the orchard subsequent to planting depends to a certain extent upon whether the land is arable or pasture. If the trees are planted in a hop garden, as is frequently the case in Kent, or if the intermediate ground is planted with bush fruit, the ordinary intensive cultivation and high manuring of the Hops or bush fruit will suffice for the Cherries. If the Cherries are planted on pasture the grass should not be allowed to grow within 4 ft. of the tree, since, if otherwise, it robs the young tree of moisture and plant food so necessary for its development. The grass round the young trees should be dug in, and dung at the rate of one load to eight or ten trees spread over the dug ground. The dung serves to prevent the grass from growing again as well as to manure the tree; and in dry summers it acts as a mulch and keeps the soil moist for the roots of the tree.

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[1] Fifth and Ninth Reports of the Woburn Experimental Fruit Farm.

Manuring the trees with dung should be repeated each year for about six years, after which time the grass may be allowed to grow again round the tree.

Cherry trees begin to come into bearing about the sixth year; if, therefore, the trees were originally planted in a Hop garden, the Hops should now be grubbed and the land be sown down to permanent pasture. If the Cherries are interplanted with bush fruit it is usual to let this continue for a longer period, gradually grubbing the bushes as the Cherries need the space, and finally laying down to permanent grass.

The normal state of a Cherry orchard in full bearing is one in which the soil is in permanent grass. The grass should be so managed that it draws the ground as little as possible. It should be grazed with sheep or pigs throughout the year as closely as possible, and it should never be made into hay, nor should the grass be allowed to seed.

The sheep, whilst being grazed under the trees, should be fed with extra food, either roots or corn, both for the purpose of manuring the trees and also because the quality of the grass under the shade of the trees is poor, and sheep will not thrive upon this alone. The value of such feeding should amount to from £3 to £5 per acre per annum, and the value of the manurial residues, about £1 per acre, will suffice for the manuring of the Cherries.

Pruning.—A Cherry tree requires very little pruning. It is sufficient merely to establish the framework of the tree and then leave it to grow undisturbed.

Excessive pruning not only retards the development of the tree, but is liable also to produce the exudation of gum from the stem and branches, and result in an unhealthy state of the tree. Summer pruning is never practised, because the fruit buds form naturally without it.

In view of these considerations it is sometimes unnecessary to prune at all, except to shorten the branches after planting, leaving about 6 in. or 8 in. of young wood. If the tree is not well balanced, and there is a vacant spot in its framework, the branches next to this vacancy should be so cut that the last bud on the branch points towards the vacancy, so that when this bud develops, the resulting branch helps to fill the vacancy and to balance the tree.

When good trees are planted it is rarely necessary to prune them more than once. The trees, however, should be examined each year to see that they are developing uniformly.

When the orchard comes into bearing it will still be necessary to examine the trees occasionally. Dead wood and ladder-broken wood must be cut out. Wherever two branches cross and rub against one another one of them should be cut off. Some trees grow too thickly in the centre; this growth also needs cutting out, since it hinders the free circulation of air through the branches, and also, as we shall see later, it is upon this centre growth that the black Cherry Aphis begins to develop in early summer.

Picking and Marketing.—Picking usually commences towards the end of June, when the early cherries are ripe, and continues with the later varieties until the end of July. The gathering is done sometimes by men and sometimes by women; in the latter case, one careful man is told off with a gang of from six to eight women, according to the crop of cherries. If the crop is large, the ladders do not need frequent moving, and consequently one man can attend to a larger number of women than if the crop is small.

Cherries are picked sometimes by piecework, sometimes by daywork, depending upon the abundance of the crop and other considerations. At the beginning of the season, when cherries are making good prices, the trees are usually picked over two or three times, and only the ripe fruit is gathered. In this case the picking is done by the day, and thus the pickers can be induced to make a good sample of the fruit. Later on in the season, especially if the cherry crop is a large one and the fruit is realizing a lower price, it is most important to secure the crop quickly at as low a cost as possible; consequently the pickers are put on by the "piece". In this case the trees are only gathered once. The earliest cherries are allowed to get dead ripe, so that the later fruit may also be ripe and ready to pick at the same time. By this piecework method the crop can be gathered at a very much lower price, ranging from 6*d.* per half-sieve upwards, but naturally the sample of fruit obtained is not so good.

During the picking season much careful supervision is necessary, not only to ensure the fruit being carefully picked and a good sample obtained, but also to see that the branches are not broken about and next year's crop impaired. Unless carefully overlooked, the pickers pull the fruit from the strigs ("plug" the fruit, as it is called) instead of picking strigs and fruit together, with the result that the juice runs out and the fruit becomes sticky and quickly rots; they are also liable to mix in green and rotten fruit with the sound sample. Much damage is also done by pickers and ladder movers breaking off the "bruts" or short fruiting branches, and thus diminishing the crop in future years.

Cherries are for the most part marketed in half-sieves, but just the very choicest and earliest fruit is often packed in pecks, and in this way sometimes realizes a higher price. In either case the cherries should be very carefully hand-picked to remove any unripe or unsound fruit which may have accidentally found its way into the gathering baskets. The half-sieves, after being lined with packing paper, are filled with cherries, and, according to recent regulations of the fruit markets, must contain not less than 24 lb. of fruit; if otherwise, the exact weight of fruit should be marked on the label. Lastly, the baskets should always contain a uniform sample of fruit. Packers, unless specially cautioned, are very liable to put the best fruit upon the top of the baskets—a practice that is easily discovered, and results in the grower obtaining a bad name upon the market and subsequent loss. Every effort should be made to obtain a good name upon the market, and when this is effected fruit can often be sold by the salesman upon receipt of invoice by telegram from the grower—a matter of no little value when there is a glut of fruit upon the market.

Varieties.—In considering cherries that are grown commercially, no attempt has been made to mention all the varieties; a few of the better known have been mentioned and their characteristics described.

For the purposes of classification cherries can be divided into four groups—White Hearts, Black Hearts, Dukes or Guignes, and Acid or Cooking cherries.

The cherries in each class have been arranged in the order of ripening.

Class I. White Hearts.—

Governor Wood.—Early. A good cropping variety. A soft cherry, and liable to Brown Rot. (See p. 86.)

Frogmore Bigarreau.—Early. A great cropping variety. It is very soft, and cracks badly in wet weather. Makes a low price, but is useful in years when the general crop is small.

Elton Bigarreau.—Second early. Fine large fruit. Crops badly, and fails on moist soils.

Amber Bigarreau.—Medium. Large, firm, and good-quality cherry. Crops well. Commands a good price. One of the best White Hearts for orchards.

Bigarreau Napoleon.—Late. Very large and firm cherry. Crops fairly well. Fruit sells well. It is a good orchard cherry, but the trees often die back.

Class II. Black Hearts.—

Rivers's Early.—Very early. Large, handsome black cherry. Crops well. Is the first good-quality English cherry to market, and sells well. A good orchard cherry.

Knight's Early Black.—Very early. Good flavour and crops well. Soft flesh.

Old Black Heart.—Early. An old variety, which crops well. Liable to crack and rot in wet seasons.

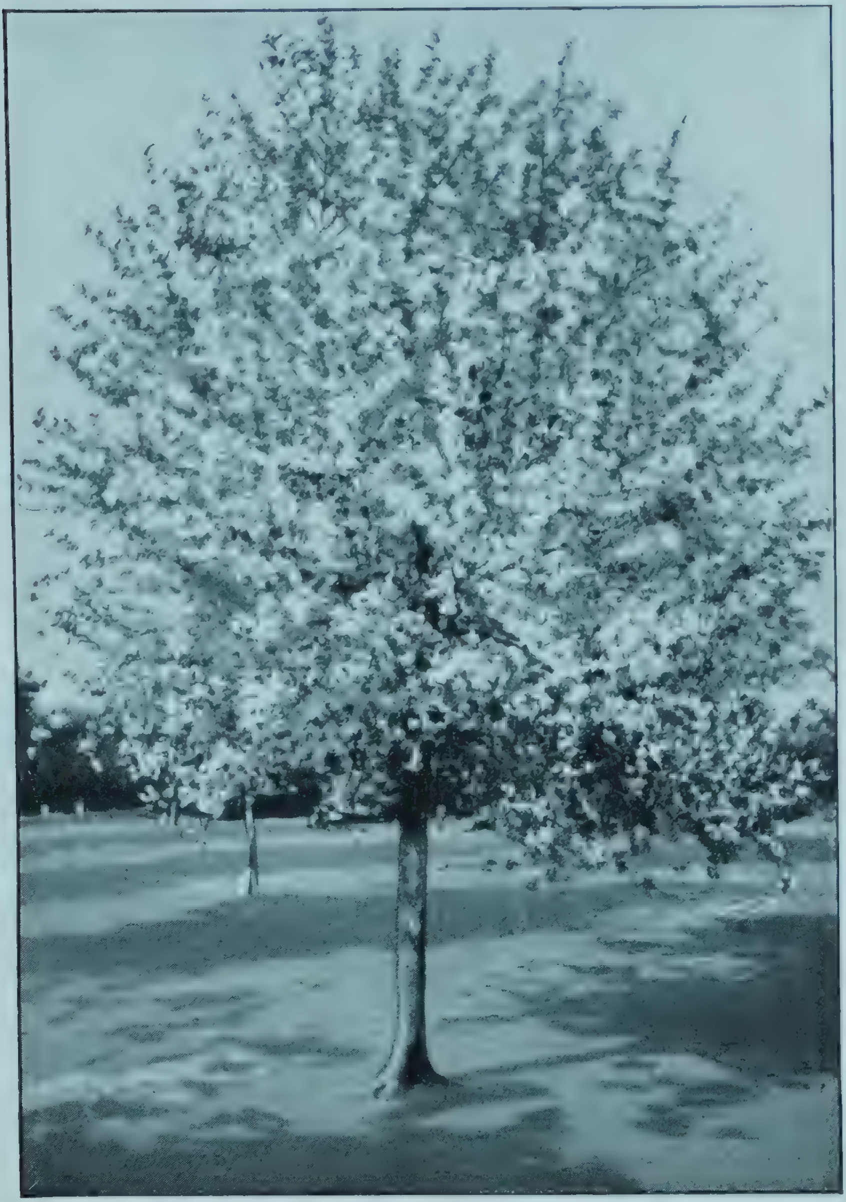


Fig. 368.—Cherry, Half Standard (Morello) in bloom

Black Eagle.—Medium. Large cherry with good flavour and firm flesh. A good-quality cherry, which sells well. Very useful orchard cherry.

Waterloo.—Late medium. Similar to Black Eagle, but not so large.

Turks.—Late. Very fine large fruit. Crops well, and is a firm cherry. A good orchard cherry.

Class III. Dukes or Guignes.—

The cherries of this class are not grown commercially to any great extent in England. The best-known variety is *May Duke.*

Class IV. Acid or Cooking Cherries.—

Kentish Red.—Medium. A good cooking cherry. Crops well. Remarkable in that the stones can be pulled out with the strig.

Flemish.—Late. Similar in other respects to Kentish but larger.

Morello.—Late. Crops well. Used for preserving and bottling. Small fruit.

§ 3. COST OF PRODUCTION AND MARKETING—RECEIPTS

It is comparatively easy to estimate the average annual cost of production upon an acre of Cherries; but, like all other fruit crops, Cherries are subject to such large fluctuations in yield from year to year that it is somewhat of a speculation to estimate the average cost of picking and marketing the crop. Thus, in years when the crop is a large one an orchard may yield upon the average as much as 6 or 8 half-sieves per tree, and individual trees as high as from 10 to 15 halves; whilst in other years, when the crop is short, the same orchard may fail to produce even 1 half-sieve per tree. In years when the crop is large, the cost of gathering the fruit per half-sieve is very much less than when the crop is small, though, of course, the total cost is much higher for the big crop.

In order to make the figures representing the cost of production as intelligible as possible, the figures have been set down in three columns. The first column represents the minimum cost of production, and is based upon the assumption that the crop amounts to 1 half-sieve per tree = 40 halves per acre. The second column represents the maximum cost of production, and is based upon a crop of 8 halves per tree = 320 per acre. The third column gives the writer's opinion of what is the average annual cost of production. It will be noticed that the figures in this column are not in all cases the mean between the minimum and maximum cost. This is done with intention, since the average cost is not, in fact, the mean between the minimum and maximum figures.

COST OF PRODUCTION AND MARKETING

Rent	£2 10 0	£6 0 0	£4 0 0
Rates and taxes (5*s.* in £)	0 12 6	1 10 0	1 0 0
Manuring (by feeding stock)	0 10 0	1 10 0	1 0 0
Replanting (2 trees per acre)	—	—	0 6 0
Grease-banding	0 5 0	0 10 0	0 7 6
Spraying	*Nil.*	1 5 0	0 5 0
Bird minding, labour, and ammunition	1 0 0	2 0 0	1 10 0
Cost of production ...	£4 17 6	12 15 0	£8 8 6
	(40 halves per acre.)	(320 halves per acre.)	(160 halves per acre.)
Gathering	3 0 0	£8 0 0	£6 0 0
Packing and putting on rail, 2*d.* ...	0 6 8	2 13 4	1 6 8
Railway carriage to market, 4*d.* ...	0 13 4	5 6 8	2 13 4
Return of empties, ¼*d.*	0 1 8	0 13 4	0 6 8
Commission, 4*d.*	0 13 4	5 6 8	2 13 4
Cost of marketing ...	£4 15 0	£22 0 0	£13 0 0
Total cost per acre ...	£9 12 6	£34 15 0	21 8 6

It is even more difficult to estimate the average returns for an acre of Cherries. The price realized is controlled by a large number of factors, the most significant of which is the total amount of the English cherry crop. If this is small, prices are likely to be high; and, vice versa, if the crop is large, prices are low. The price also depends to a considerable extent upon the supply of other fruit, and especially upon the supply of Strawberries. A glut of strawberries reacts seriously upon the price of cherries. Another factor influencing the price is the variety of Cherry, the best-quality cherries—such as Rivers's Early, Black Eagle, and Napoleons—frequently realize double and treble the price obtained for such inferior varieties as Frogmores.

The average crop has been roughly estimated at 160 half-sieves per acre, and upon this basis the cost of production and marketing amounts to £21, 8*s.* 6*d.* per acre. If we assume an average return of 3*s.* 6*d.* per half-sieve, this will yield £28 per acre, and leave a profit of £6, 11*s.* 6*d.* per acre. [A. A.]

§ 4. DISEASES AND PESTS OF THE CHERRY

Cherry-leaf Scorch (*Gnomonia erythrostoma*).—This disease is the cause of considerable loss both in this country and on the Continent. The symptoms are very marked, and cannot be confounded with those produced by any other known disease. The leaves that are attacked by the fungus during the summer remain hanging on the trees throughout the following winter, and after the next crop of leaves have appeared, which become infested in turn by spores produced on the old dead leaves. Hence when a tree is once infected the disease usually continues to appear each succeeding season. Trees that have suffered from the disease for several seasons make very little wood, owing to the leaves turning yellow and dying early in the season; the crop of fruit gradually decreases in quantity and quality, and eventually the tree dies. The fruit is also frequently attacked, when it either falls before maturity or becomes distorted and worthless. It must be clearly understood that the leaves and fruit are the only portions of the tree attacked by the disease, therefore if all such are removed no infection could take place the following season. This practice has been followed in Germany, where the disease is rampant, and with the most satisfactory results. After carefully removing all dead leaves during the winter for two consecutive seasons the disease was stamped out. Afterwards the trees recovered and produced fruit in abundance. It is, of course, more satisfactory, where a whole area is infected, that the clearing away of leaves should be general; but this is expecting the impossible. Yet, as the disease does not spread rapidly, it would well repay doing in a single orchard, even when surrounded by diseased ones.

Salmon has demonstrated that by spraying with Bordeaux mixture the disease can be held in check. Two thorough sprayings were applied, one just before the flowers opened, a second soon after the petals had fallen.

Very few dead leaves remained on the treated trees, which were nearly restored to health in a single season. Of course, so long as untreated trees are growing in the neighbourhood, the trees must be sprayed every season, and the fundamental cause of the disease remains untouched. This can only be exterminated by the removal of all dead hanging leaves. and burning them, throughout the entire district affected, and if looked upon in the light of an investment, time would prove it to be a very remunerative one.

Brown Rot (see p. 86) also attacks Cherries, and is best checked by spraying with Bordeaux mixture before the flowers open, and again just after the fruit has set. [G. M.]

There are two insects that stand out prominently as doing damage to cherries: The Winter Moth Caterpillar and the Cherry Aphis or Black Fly.

Winter Moth Caterpillar.—In former years the damage done by this caterpillar to Cherries and other fruit trees has been enormous. Its life-history is now well known, and as this is fully described at p. 76, as well as the grease-band method for catching the moths, it will not need repetition here.

The Cherry Black Fly (*Myzus ribis*) is known all over Europe, Asia, Africa, Australia, and America. It often swarms on the shoots, and gets into the leaves and curls them up. When numbers are collected together they form such a copious amount of honey dew that it drops into the fruit. Upon this honey dew the "soot fungus" grows, and so the fruit is spoilt. The result of the attack on the tip of the shoots is that they die and turn brown. The rather shiny black Aphis has yellowish and black legs. The wingless females breed with great rapidity. In July they change to pupæ which have an olive-green hue with dull-yellowish wing cases. The winged viviparous females from these leave the Cherry, but where they go to we do not know. This Aphis returns to the Cherry in the autumn, and eggs are laid on the trees.

TREATMENT.—Treatment consists of heavily washing the trees with soft soap and quassia. This should be done before they have commenced to curl the leaves. If the trees are small, the best remedy is to wash them with a strong solution of soap and quassia extract, using 8 or 10 lb. of each ingredient to 100 gall. of water. In washing to kill this Aphis it is above all necessary to use a coarse spray *and great force*, so that the wash may penetrate the curled leaves and kill the Aphis.

The following other insects attack the Cherry: Winter Moth (*Cheimatobia brumata*), Mottled Umber (*Hybernia defoliaria*), Figure-of-8 Moth (*Diloba cæruleocephala*), Lackey Moth (*Clisiocampa neustria*), Gold-tail Moth (*Porthesia similis*), Buff Tip (*Phalera bucephala*), Wood Leopard (*Zeuzera pyrina*), Cherry and Plum-tree Borer (*Semasia woeberana*), Cherry-fruit Moth (*Argyresthia nitidella*), Pistol-case Bearer (*Coleophora anatipenella*), Bark Beetle (*Scolytus rugulosus*), Chafers (*Melolontha vulgaris, Phyllopertha horticola*), Leaf Weevils (*Phyllobius oblongus* and *P. maculicornis*), Cherry and Pear Slugworm (*Eriocampa* *limacina*), Cherry Bug (*Tropicoris rufipes*), Cuckoo Spit (*Philænus spumarius*). [F. V. T.]

Birds.—Under this heading of Cherry Diseases and Pests, the birds that prey upon the ripe fruit must be included. The worst offenders in this respect are Blackbirds, Missel Thrushes, Song Thrushes, and Starlings. As soon as the cherries begin to colour, and long before they are fit to gather, these birds begin to eat the fruit, and keep coming during all the hours of daylight.

The only effective means of keeping the birds away is to have a bird minder constantly in the orchard with a gun. In this way one man can usually keep the birds from an orchard from 8 to 10 ac. in extent.

PEACHES AND NECTARINES

§ 1. GENERAL

The Peach and Nectarine are both forms of Prunus or *Amygdalus Persica*, or *Persica vulgaris*, the wild form of which is supposed to be of Asiatic origin. The chief difference between the Peach and Nectarine is that the former has a downy skin to its fruit, while the latter has a smooth one. That they are intimately related is clearly shown by the fact that sometimes fruits, part Peach and part Nectarine (fig. 369) will be borne on the same plant. Instances are also recorded of a Peach arising from the seed of a Nectarine and vice versa.

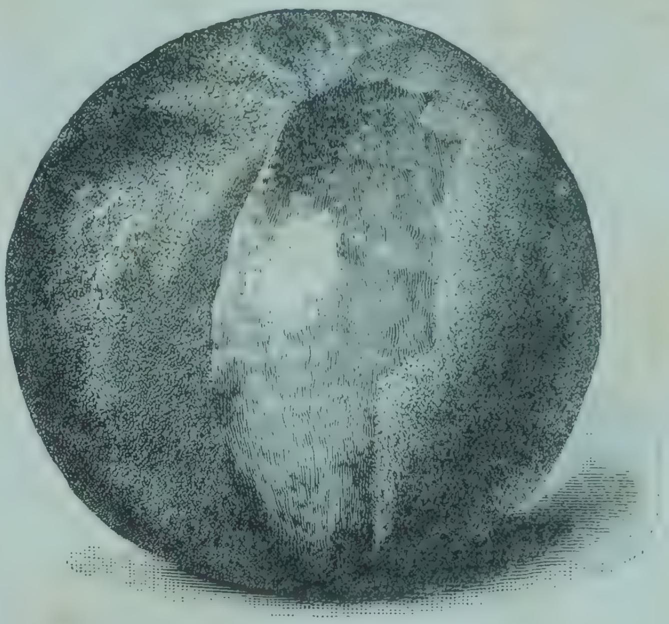


Fig. 369.—Fruit, part Peach, part Nectarine

Peaches and Nectarines are easily raised from seed, but established varieties are nearly always propagated by budding, although sometimes by grafting, on seedling stocks, or on stocks of Cherries, Almonds, or Plums. Varieties of the latter known as the "Mussel" and the "Brompton" are the stocks most generally used by British growers.

The leaves of Peaches and Nectarines are long and lance-shaped, the margins being either serrately or crenately toothed. Leaves with serrate edges are sometimes destitute of those mysterious glands on the leaf stalk, while those with crenate margins usually have roundish or kidney-shaped glands.

The flowers vary in colour from pure white to rose pink and bright crimson. In some varieties the flowers are small, in others comparatively large, and it is thought by some that the small-flowered varieties resist frost better than the large-flowered ones. It would be interesting to have scientific proof of this.

So far as the fruits are concerned they are classed as "clingstones" when the flesh is firm and adheres to the wrinkled stone, and as "freestones" when the flesh separates easily and cleanly from the stone.

§ 2. CULTIVATION

Where there are suitable walls, the culture of this fruit is advisable. If done well it will add éclat to the collection on the grower's stand and attract the notice of the better class of retailer, who can be made a customer for other things by a salesman with his wits about him. If the goods are sent for sale on commission these remarks do not apply, because it will probably be desirable to send such goods as peaches to a different salesman from the one that sells the ordinary produce. If peaches are attempted, enough attention must be paid to them to do them properly or they had better not be touched at all.

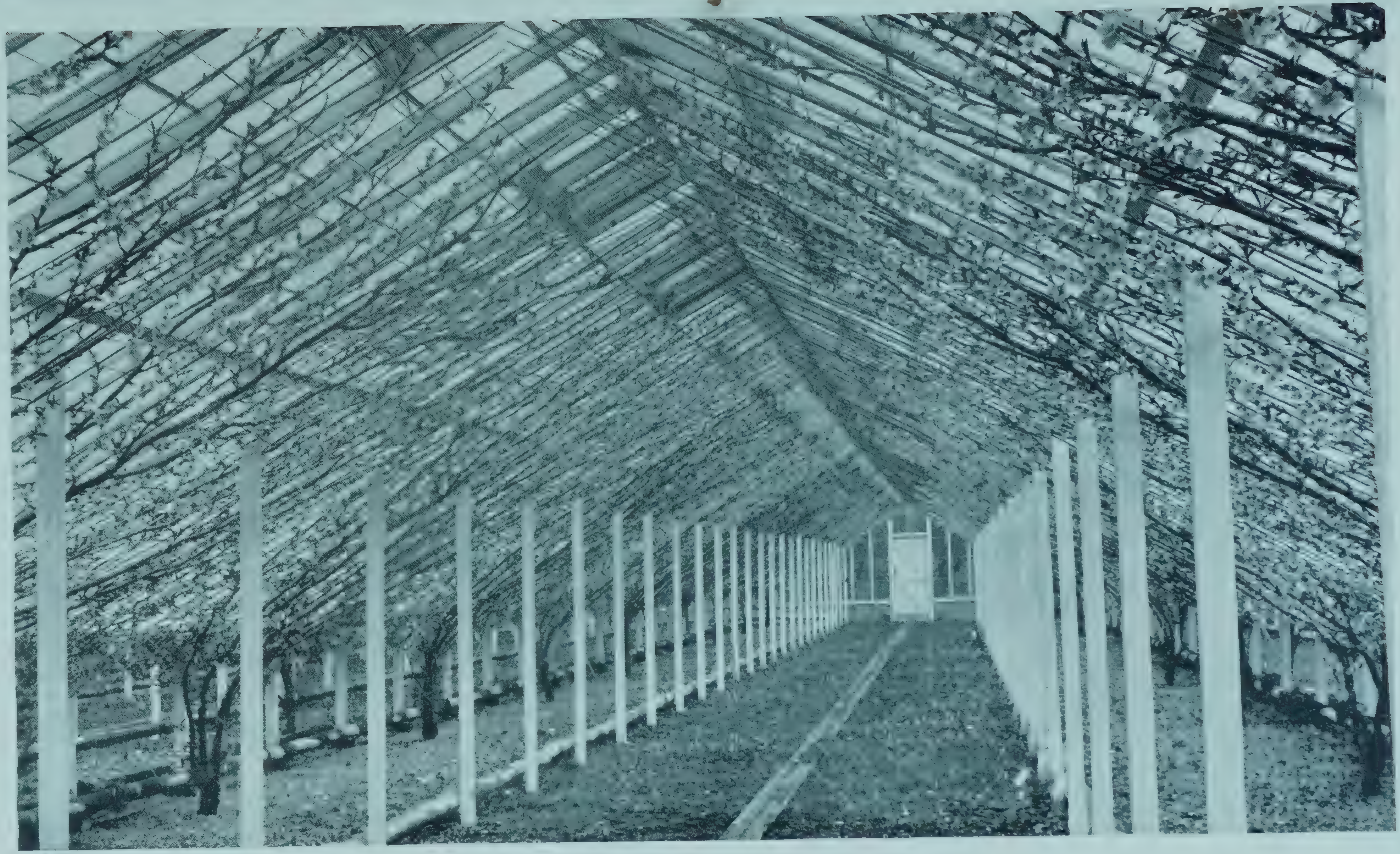
The soil for them must be good, with plenty of humus and lime in it. The drainage must be good, and the means must be at hand for watering freely during dry summer weather. Thought is necessary in selecting sorts. Peaches are fruit that do not yet find their way to the table of the humbler and most numerous class of our population. Near large centres of population, therefore, it will not be wise to get this fruit on the market when the out-of-town season is in full swing. This presents a difficulty, because unless the grower is careful he will get the bulk of this fruit in during August.

"Hale's Early", "Early Alexander", and "Waterloo" may be got on to the market at the end of July, but after these two it is better, except where seaside towns are catered for, to depend on September and October fruiting varieties. It must be remembered that in Peaches the public seem much more concerned with appearance than flavour. Apparently the Peaches on the dessert dishes are relied on more for the tone they give to the eye than for the taste they bring to the palate. Good-flavoured Peaches, like "Noblesse", that have not colour, are discarded for varieties like "Prince of Wales", that carry a high colour.

Sorts worth planting are: "Royal George" (mid September), "Barrington" (mid September), "Sea Eagle" (end September), "Osprey" (early October), and "Salwey" (late October).

The grower need not buy two-year trained trees, for which he will have to pay 3*s.* 6*d.* to 4*s.* each. Two-year cut back or one-year trained will do, which can be bought at 12*s.* to 18*s.* per dozen.

Prepare the place for the young trees by working in some turfy



PEACH HOUSE WITH TREES IN BLOOM

In Mr. Larsen's Nursery, Waltham Cross, Herts

loam with crushed bones and seeing that the soil has been moved two-spit deep. Don't put a lot of fresh stable manure in when planting, but defer planting until a year or two of regular generous manuring has brought your soil up to concert pitch. If lime is needed in the soil, let this be applied the year before planting. Plant the young trees a few inches from the wall, sloping a little towards it. The distance apart should be about 12 ft. Don't cut back. A topdressing of manure during summer is helpful.

Several new plans of securing the branches to the wall have been tried, but none supersede for effectiveness the old plan of nailing to the wall, with a shred to hold the shoot.

It must be remembered that the object of planting against a wall is not only to secure the shelter of it from northerly or north-easterly air currents, but to secure for the trees and fruit the benefit of radiation of the sun heat which the wall gives off. Systems like wire trellis, which —to secure neatness or in search for economy—leave a space between the wall and the trees, defeat this main object and offer a draught where the tree asks for warmth. Various devices are in vogue to protect the blossoms from frost in spring, from glass copings and roller blinds to hangings of fish nets. There are growers who declare that as good crops can be obtained, taking one year with another, without any protection as with it. When we remember that in nine cases out of ten the fruit crop is made or marred by the manner in which the wood is ripened in the autumn, and that the frost in spring frequently but executes the sentence then pronounced, we must admit that there is much to be said for the "no protection" advocates. When the fruit has fairly set and commenced to swell, thinning must be done. Here is a great trial for the grower. If he has a man he can trust to do it he had better not attempt it himself. Many more Peach crops are spoiled by too many fruit being left on than by any of the raids of Jack Frost. One good large peach is worth at market three small ones. Let the fruit be thinned so that there is plenty of room for each to swell and not one more than the tree can find sustenance enough to bring to perfection.

The summer growths will need careful thinning out in July, only those wanted to fill the wall space being left, and these fastened back by pieces of rod end or other sticks inserted under the nailed branches, care being taken in doing it to uncover the fruit to the sun's rays.

Nectarines.—All the cultural remarks for Peaches apply to this fruit too. One Nectarine will be planted to about four Peaches.

Good Nectarines to plant are "Early Rivers" (very prolific), "Cardinal", and "Lord Napier". [W. G. L.]

Peaches and Nectarines under Glass.—Peaches and Nectarines are grown in many places under glass as a market crop. Of course these fruits are nearly always to be found in large private gardens, from which the surplus produce often competes in the market with that of the commercial grower. The houses in which Peaches are grown are either "lean-to" or "span". In the former case the trees are planted on the side farthest from the wall, as shown in fig. 370, the shoots being trained up wires beneath the glass, and 12 to 15 in. from it. To secure an early crop, hot-water pipes are necessary, and from four to six rows of 4-in. pipes are laid along the sides and down the centre. In the case of span-roofed houses the trees are planted along each side about 12 ft. apart, thus giving each a spread of 6 ft. on either side. The length of Peach houses varies for market work from 100 to 200 ft. and more, and small houses may be only 12 ft. wide and 6 to 8 ft. high from floor to ridge. In many establishments houses formerly used for grapes are now being utilized for Peach growing. The low prices realized for grapes of late years have brought about this change, and wherever an old Vine is cut out, a Peach or Nectarine takes its place. It is therefore possible that the Peach houses of the future may be the grape houses of the past, and may be any size up to 500 or 600 ft. long and 20 to 30 ft. wide. (See the Plate.)

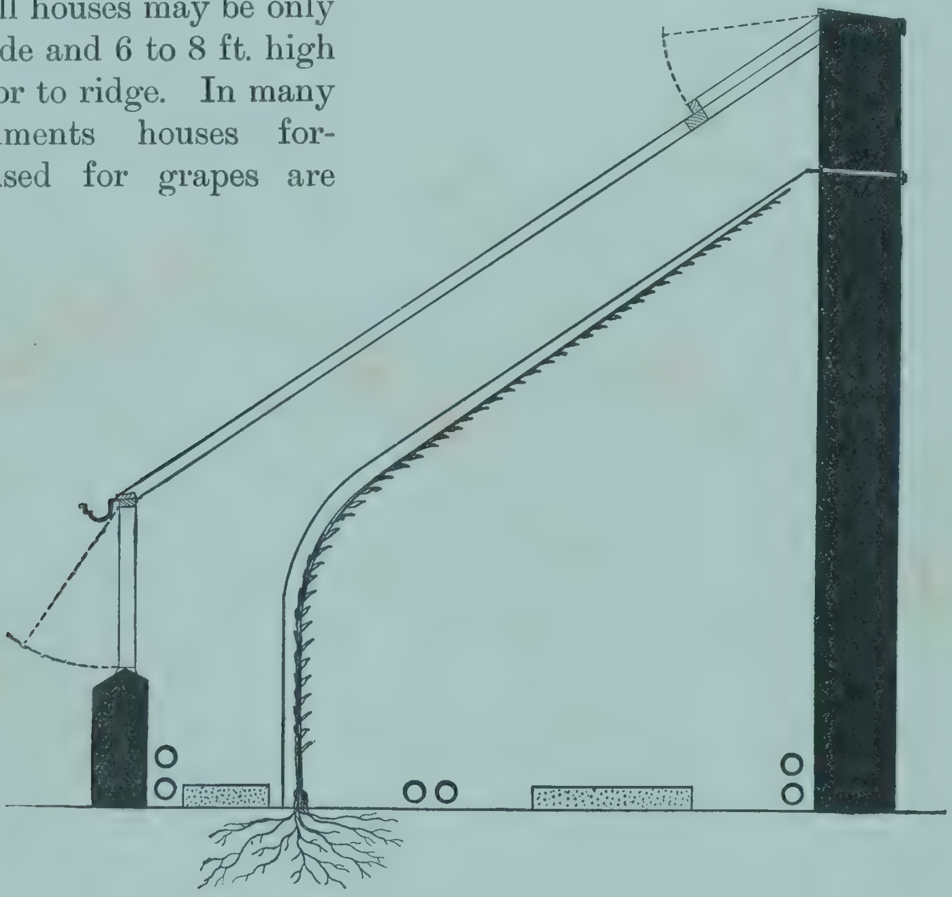


Fig. 370.—Early Peach House. Scale ¼ in. to 1 foot

Before planting, it is advisable to turn the soil over to a depth of at least 2 ft., but 3 ft. would be better, especially if the soil is at all retentive. Stagnant moisture at the roots would be a great drawback, and can only be got rid of by deep cultivation to secure good drainage and greater warmth for the root fibres. The soil should be of a rich loamy character, if possible, and if not naturally rich in chalk or lime this should be added. Old mortar rubble is an excellent thing to mix with the soil in Peach borders; and when the young trees are well established a dressing of bone meal every second or third year, or basic slag about December or January, will be beneficial. Humus must be added by a topdressing in winter, with well-rotted manure, but to guard against acidity this should be followed in spring with a sprinkling of lime or basic slag.

To keep the shoots at a proper distance from the glass, a wire trellis with strands running horizontally and vertically, as shown in the Plate, will be necessary. These wires should be fairly stout and well strained to secure rigidity. The best distance from the glass is 12 to 15 in. This secures not only a free passage of air between the leaves and the glass, but also prevents scorching. The grower also can push his head through in places to see that the fruits are properly exposed to the ripening influence of the sun.

To secure an early crop of peaches, fire heat may be started early in January. At first very little should be given until the plants are fairly starting into growth, and a night temperature of 45° F. will be sufficient. Later on the temperature may be gradually raised to 50° when the plants are in flower, and then 55° after they have begun to set. The day temperature will be from 5 degrees to 10 degrees higher. Care must be taken not to have it too high, say above 65° F., until the young fruits are well advanced. Attention, therefore, must be given to ventilation on all favourable occasions, and the atmosphere must be kept in a fairly moist condition by watering and syringing. Each afternoon the trees should be well syringed to keep the leaves clean, to keep down red spider, and to encourage rapid growth.

During the season it will be necessary to tie in the best of the new growths for next season's fruiting, and to pinch or cut out unnecessary ones. The proper arrangement of the wires makes this a fairly simple matter with a piece of twisted raffia.

Thinning out the fruits is practised to secure a fair crop of good size, and to prevent the trees exhausting themselves too much.

Trees in small houses, planted 12 ft. apart, will ripen on an average five dozen fine fruits. This gives roughly one fruit to every square foot of the tree; and larger trees may have their fruits thinned out to the same proportion to secure good crops. It is, however, recorded that early Peach trees covering 300 sq. ft. of trellis have produced thirty-five dozen fruit. By reckoning one peach or nectarine to every square foot of glass one may estimate fairly accurately the crop of any particular house, and the same may be said of Peaches grown in the open air. First-class fruits will realize from 8*s.* to 20*s.* per dozen, while seconds may secure anything from 2*s.* 6*d.* to 5*s.* per dozen. The grower, therefore, who takes care of his crop and aims at securing the finest fruits is the one most likely to obtain the highest prices. In these days of keen competition the best produce not only fetches higher prices, but also sells much quicker than the lower-grade material.

Peaches and Nectarines in Pots.—Although nurserymen and private gardeners grow these fruits in pots or tubs, the practice has not yet been adopted by market growers to any extent. There is no reason, however, why it should not be, especially where there is already plenty of glass, and where the grower is sometimes at his wits' end to know how to utilize it to the best advantage. Even cool houses, or houses with very little hot-water piping, might be utilized for growing a crop of Peaches and Nectarines. Young trees two or three years old, trained pyramid fashion, as shown in the sketch (fig. 371), or as half-standards (fig. 372), may be obtained from the nurseryman to save time, or maidens may be bought more cheaply and grown on.

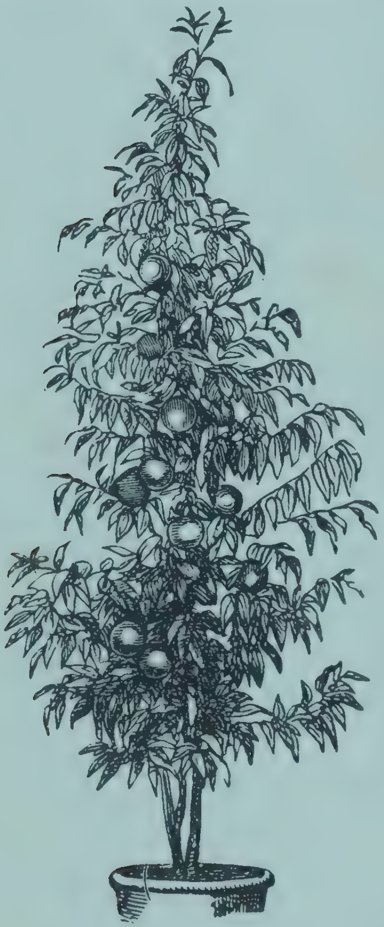


Fig. 371.—Pyramid Peach

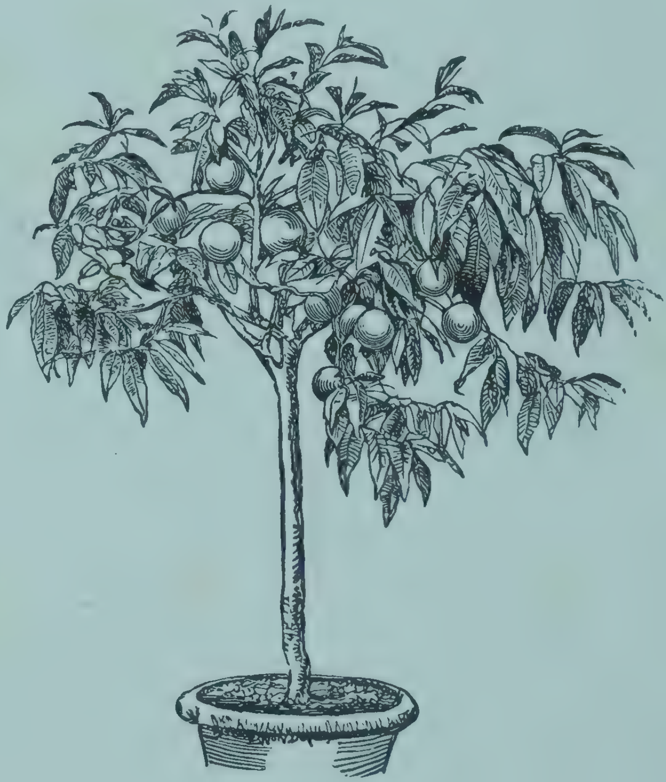


Fig. 372.—Half-standard Peach

They should be potted up in October or early November, using a compost of rich turfy loam, and about half the quantity of well-rotted manure, with some bone meal and crushed mortar rubble. The pots should be well drained, and the sizes may vary from 10 to 12 in. The soil should be rammed firmly round the roots, the plants afterwards being plunged in a border or in a bed of ashes so that the rims of the pots are covered by 2 or 3 in. This will guard against frost. The plants may be brought under glass early in January, and might well follow Chrysanthemums. The cultural treatment would be practically the same as for Peach trees planted in borders permanently, attention being given to syringing, ventilating, and heating. Watering will require more attention, as the plants are in pots, and there will be no trouble in tying in shoots.

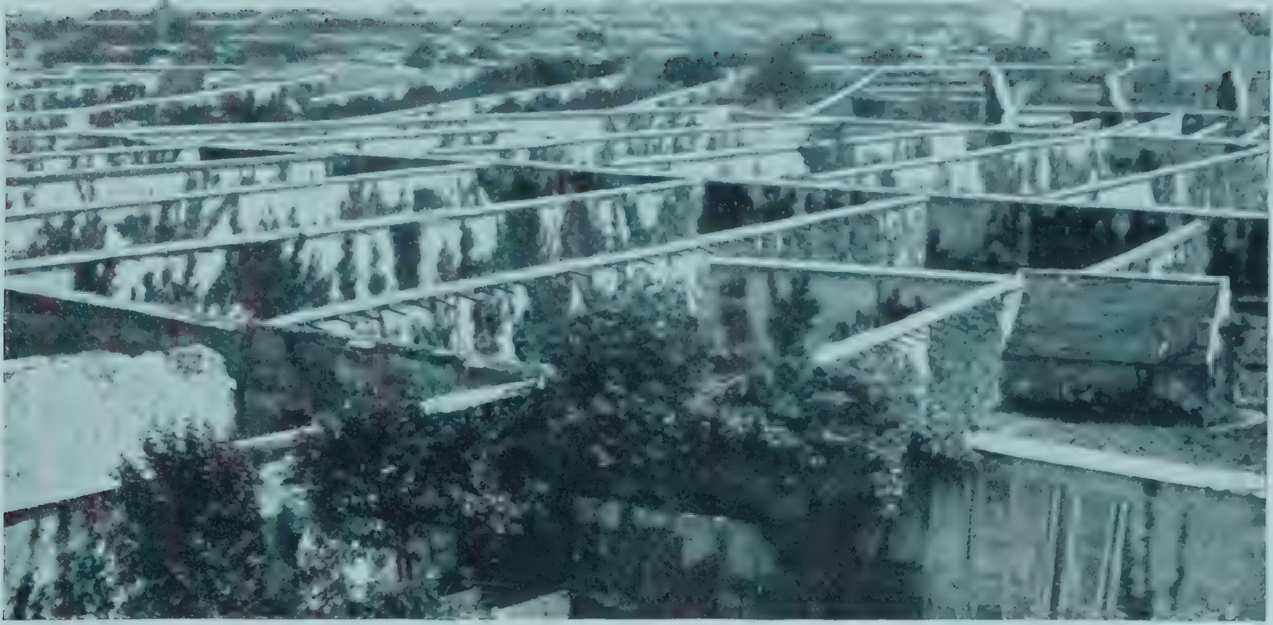
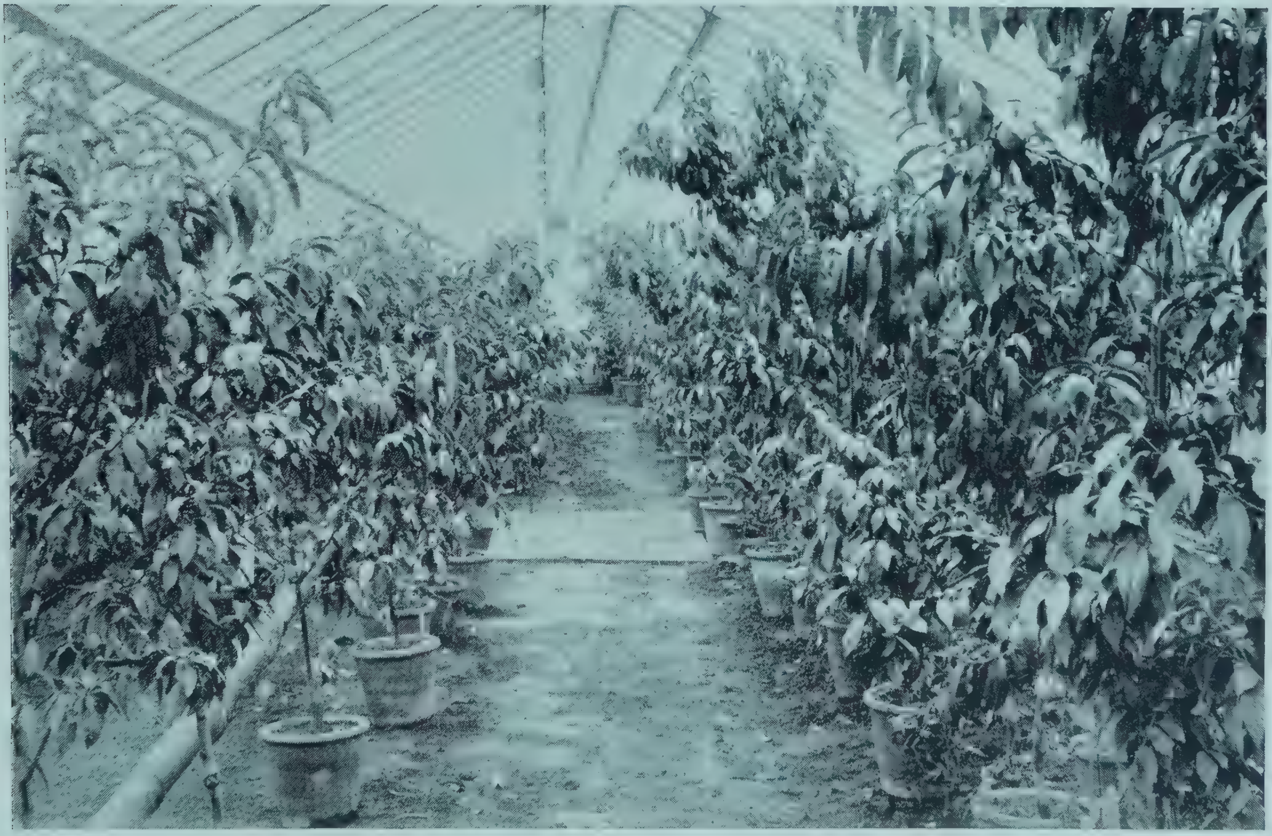


Photo. Chas. L. Clarke

A FRENCH PEACH FARM

Showing how the plants are grown on walls



10,

PEACHES GROWN IN POTS UNDER GLASS

Useless ones are pinched out, and the fruits are disbudded in due course. In this way a plant in a 10-in. or 12-in. pot may carry from two to three dozen fruits, for which good prices may be obtained. The advantage of growing Peaches, Nectarines (and, it may also be said, Cherries, Plums, and Apricots) under glass in pots is that, after the fruit is picked, the plants can be plunged in the open border to ripen their wood, and the house may be used for other crops, like Cucumbers or Tomatoes, until the following autumn.

Varieties of Peaches.—The following are some of the best Peaches:—

Alexander.—Fruit large, round, somewhat flattened, greenish white on shaded side, very dark-red where exposed to the sun; good flavour. The best of the early varieties, but difficult to manage under warm treatment under glass, owing to premature development of the buds in the autumn, which causes them to fall in the spring; good for a cold house. Ripe about 19 July.

Alexander Noblesse.—Fruit very large, round, pale, with some red dots on the side next the sun. A seedling from the old Noblesse, but not so subject to mildew. Ripens middle of August.

Barrington.—Fruit large, longish, downy, pale-yellowish green, deep red next the sun; flesh whitish green; high flavour. Mid-September.

Bellegarde—Fruit large, globular; skin dark red, pale green, streaked with dark purple or violet next the sun, slightly tinged with yellow on the shaded side; melting, juicy, rich. Ripens mid-September.

Crimson Galande.—Fruit medium, round, somewhat flattened, and often indented at the apex; pale, speckled with red, very dark red on the sunny side; excellent flavour. One of the very best. The tree has a good constitution, bears freely, and stands forcing well. Late August.

Dagmar.—Fruit large, handsome, somewhat elongated, dotted and shaded with red, highly coloured next the sun; of good flavour. A first-rate cropper. Early August.

Dr. Hogg.—Fruit large, round, very pale yellow, with a slight tinge of crimson; sweet rich flavour. Ripe about the first week in August.

Dymond.—Fruit large, round and even, greenish yellow with red dots, bright red next the sun; good flavour.

Early Alfred.—Fruit large, elongated, often bearing a nipple at the apex, yellowish green dotted with red, bright red where exposed to the sun; good flavour. Useful for forcing. Early August.

Early Beatrice.—Fruit medium, roundish, marbled red on sunny side. One of the earliest. The fruit is much larger if the tree is worked on the Brompton stock. Mid-July.

Golden Eagle.—Fruit round, very large, deep yellow, highly coloured with red next the sun; rich piquant flavour. Early October.

Goshawk.—Fruit large, round, green, striped and flushed with dull red next the sun; exceptionally rich flavour. One of the finest mid-season varieties.

Grosse Mignonne (Early).—Fruit large, round, somewhat depressed, hollowed at the summit, furnished with a deep suture; pale yellow mottled with red towards the sunny side, which is of a dark-red colour; very rich and vinous. The fruit does not bear carriage well; forces well, and is not subject to mildew. Late August, early September.

Hales' Early.—Fruit large, round, green flushed with red, dark crimson where exposed to the sun; moderately good flavour. Ripe about the end of July.

Late Admirable.—Fruit large, roundish, somewhat oblong, with a slight depression at the summit, in which there is commonly a small nipple; dull crimson with dark streaks next the sun, pale green on the shaded side, slightly mottled at the junction of the two colours. One of the best late Peaches either for the open ground or forcing. Mid- or late September.

Noblesse.—Fruit large, globular, depressed on the summit, sometimes rather pointed; pale-yellowish green, streaked and blotched red on the side next the sun; rich and excellent. Early September.

Osprey.—Fruit large, creamy, tinted with crimson. Ripe mid-September.

Prince of Wales.—Fruit varying much in shape; green, shaded with very bright red where exposed to the sun; good flavour Bears abundantly. Mid-September.

Princess of Wales.—Fruit very large, round, and pointed; pale cream with a rosy cheek; melting, juicy, rich, and excellent. Excellent for late supply. Late October.

Rivers's Early York.—Fruit medium, ovoid; greenish white, deep red on the side next the sun, often much spotted and mottled on the shaded side; fairly rich flavour. Early or mid-August.

Royal George.—Fruit large, globular; deep red next the sun, pale greenish white dotted with red on the shaded side. Late August.

Salwey.—Fruit large, round, flattish; greenish-yellow colour, darker on sunny side. Ripe end of October and early November.

Sea Eagle.—Fruit very large, somewhat elongated; greenish-white, bright red where exposed to the sun; good flavour. An excellent Peach for a cool house, but not suitable for outside culture north of London. Late September.

Stirling Castle.—Fruit medium, roundish; light, with a marbled-red cheek. A fine Peach, ripening in early September.

Violette Hative.—Fruit medium, round and even; greenish white, dark red where exposed to the sun; good flavour; travels well; ripe middle of September in the open; bears forcing well.

Walburton Admirable.—Fruit large, round, pale-yellowish green, crimson next the sun, mottled and clouded with darker colour; high flavoured. Ripens end of September or early October. The tree is very hardy, and a good bearer.

Waterloo.—Fruit above medium size, bright red; high flavour. Ripe mid-July.

Varieties of Nectarines.—The following are good varieties of Nectarines:—

Balgowan.—Fruit larger than Violette Hâtive, roundish oval, broadest at the base, greenish-yellow, mottled with dull red, dark red next the sun. Early September.

Cardinal.—Fruit medium; pale green, bright red on the side exposed to the sun; flavour excellent. The earliest of all Nectarines. Forces and bears well.

Dryden.—Fruit large, green, dotted with red, dark red on the sunny side; good flavour. One of the very best. Mid-September.

Early Rivers.—Fruit extra large, greenish white, bright red where exposed to the sun; of excellent flavour. Like Lord Napier, but ripens in early August.

Elruge.—Fruit middle-sized, roundish, inclining to oval; pale green, dark violet-red next the sun; forces well. Late August.

Humboldt.—Fruit very large, round, or inclined to be conical; yellowish green, dark red where exposed to the sun. Mid-September.

Lord Napier.—Fruit extra large, round; pale green, bright red where exposed to the sun; excellent flavour. One of the very best Nectarines. Late August.

Pine Apple.—Fruit large, roundish, inclined to conical; yellow, dark red where exposed to the sun; excellent pineapple flavour. Late September.

Pitmaston Orange.—Fruit large, globular or almost heart-shaped, terminating in a small point or nipple; deep purple, spotted with brown next the sun, orange on the shaded side. Late August.

Rivers's Orange.—Fruit medium, round; yellow, dark yellow where fully exposed. Early September.

Spenser.—Fruit of the largest size, roundish, somewhat elongated; green, dull red where exposed to the sun. Mid-September.

Stanwick Elruge.—Fruit large, roundish, often elongated; pale green, bright red on sunny side. A great improvement on the old Elruge for size and colour. Mid-August.

Victoria.—Fruit similar in every respect to Stanwick, but does not crack. One of the highest flavoured and best. Late August.

Violette Hâtive.—Fruit medium, roundish; yellowish-green, dark purplish-red, mottled with pale-brown dots next the sun. A good forcer. Late August or early September.

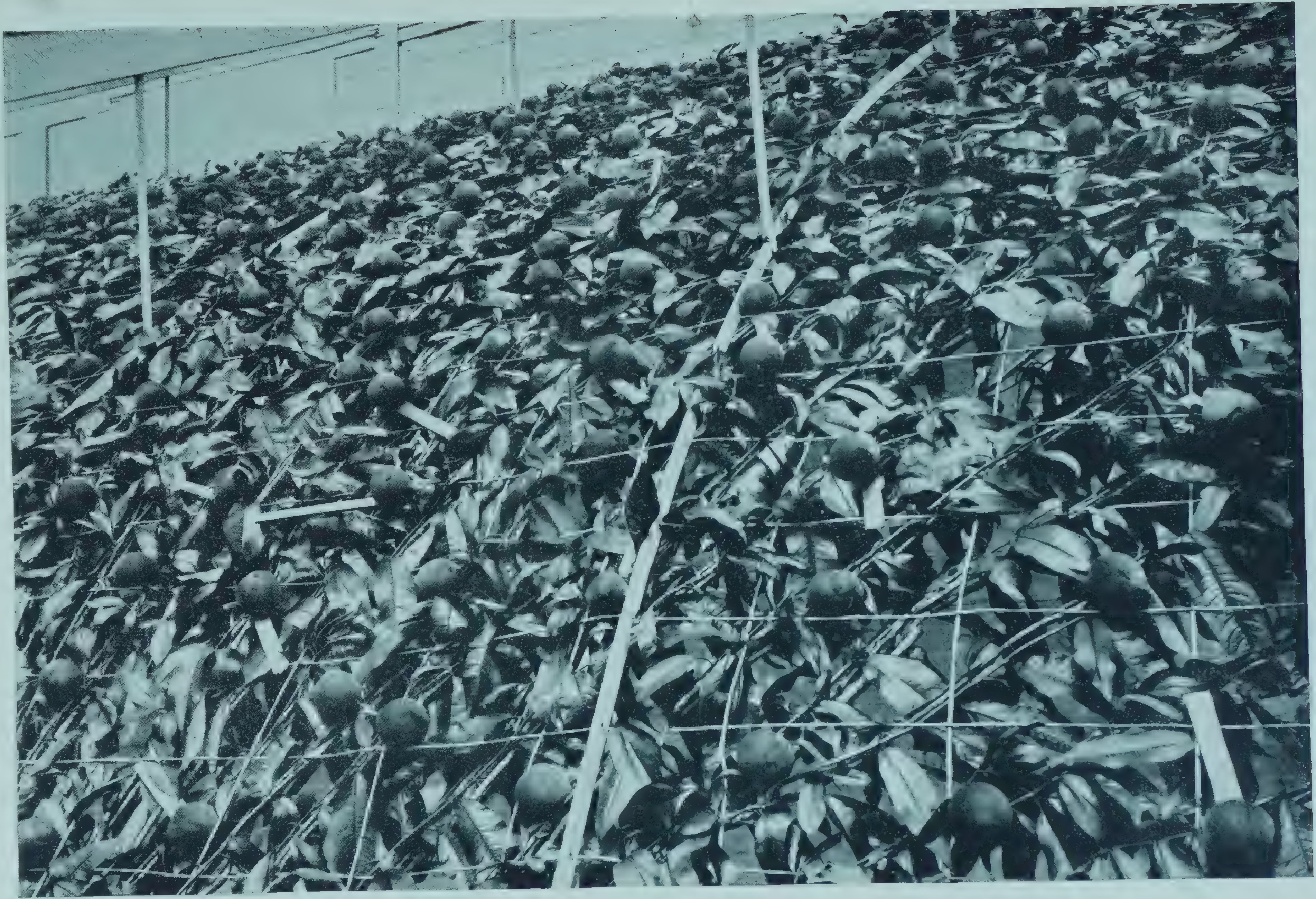
§ 3. FUNGOID DISEASES OF THE PEACH TREE

Peach-leaf Curl (*Exoascus deformans*).—This very destructive disease is present wherever the Peach tree is cultivated. The foliage and the young shoots are the parts affected. Diseased leaves are thicker than healthy ones, and are very much puckered and more or less curled. The colour is at first a pale sickly green, gradually changing to rosy or sometimes bright red. Eventually the diseased leaves become covered with a delicate white bloom, resembling the bloom on a grape. This bloom consists of myriads of spores of the fungus growing in the tissues of the leaves, These spores are conveyed by wind and other agents to neighbouring young leaves and shoots, and by such means the disease is spread. In some instances the leaves only are attacked, and usually form a sort of rosette at the end of the shoot. In many instances, however, the shoot is also attacked, which is indicated by a more or less pronounced swelling or thickening near the tip. Now when a shoot is attacked the mycelium or spawn becomes perennial in the tissues; that is, it lives in the tissues from year to year, and each season passes into the new leaves, which become infected. The injury caused by this disease is a loss of foliage which impoverishes the tree, and tells very materially on the quantity and quality of fruit, also on the general growth of the tree, as when shoots become infected they never form any more wood.

So far as preventive methods are concerned, my advice is to prune all shoots showing leaf curl about 6 in. behind the point where the leaves are produced. The mycelium of the fungus present in the shoots never extends backwards towards older wood, but invariably advances along with the new shoots, where the richest store of food is present to supply food for the growth of the new shoot, into which the mycelium of the fungus passes. Where the disease has existed the trees should be sprayed the following spring with self-boiled lime-sulphur mixture, first just when the leaf buds are expanding (see p. 50).

Peach Mildew (*Podosphæra oxyacanthæ*).—This destructive mildew attacks Apple, Peach, Quince, Cherry, and various other fruit trees belonging to the Rose family, but the Peach suffers most, as the fruit is so frequently attacked. When the fruit is about half-grown, one or more whitish patches appear on its pale-green surface. These patches gradually increase in size and present a powdery appearance, as if sprinkled with flour. These patches represent the summer fruit of the mildew, and this is the stage in which the disease is first noticed by the grower, judging from the numerous examples received for identification during an experience of twenty-five years. Nevertheless, in ninety-nine cases out of a hundred, the mildew first appears on the young leaves and shoots, and from thence passes on to the fruit. If a careful watch is kept soon after the leaves are developed, and the mildew arrested on its first appearance on the foliage, by spraying with sulphide of potassium, the fruit would be saved from attack. On the other hand, if the fruit once becomes infected, spraying is practically useless, as the dense mat of down on the surface of the fruit protects the fungus from the fungicide (see p. 51).

"Die-back" of Peach Shoots (*Næmaspora crocea*).—Practically everyone concerned in the cultivation of plants has grasped the fact that fungi can cause diseases. This mostly accounts for the statement repeatedly made, that diseases are much more prevalent now than in times past. There is no evidence to show that such statements are correct. They certainly prove that more attention is being paid to the subject than heretofore.



WIRE TRELLIS IN A PEACH HOUSE AT THE HENDRE, MONMOUTH

A peculiar disease of Peach trees has been recorded from many localities of late. In the spring the leaf buds on the terminal two-year-old shoots expand quite normally, without the slightest suggestion of disease, but just about the time when the blossom is fully expanded, the young leaves suddenly wilt, turn brown, and die within a few days. This is followed by the browning of the petals and the drooping of the flowers, which soon die, but remain hanging for some time, as also do the leaves. The general appearance of such shoots suggests frost, and most probably their death is frequently attributed to this cause, which is, however, not correct, the death of the shoot being caused by a parasitic fungus. During the summer the shoot changes to a deep claret or brown colour, shrivels, and dies. About midsummer, when the dead leaves and flowers have been removed by wind and rain, the dead shoots are very conspicuous, projecting as spikes beyond the living portion of the tree on every side. If such dead shoots are examined the following spring, they will be found to be more or less thickly studded with minute, dull, orange-coloured hair-like bodies. These are the spores of the fungus that ooze out in gelatinous masses, which adhere to the feet of birds or insects, or are washed by rain on to the young shoots of the season, which become infected and perish in turn. From the above account it will be seen that no new wood can be produced when the disease has once gained a foothold, as the young shoots are infected as soon as they appear.

The obvious remedy is to remove all dead shoots during the winter. When a tree has been infected, it would be wise, in addition to removing all dead shoots, to spray in the spring, when the shoots are about 1 in. long, with self-boiled lime-sulphur mixture (see p. 50). [G. M.]

§ 4. INSECT PESTS

The Peach Scale (*Lecanium persicæ*).—This is usually found on peaches under glass, but now and then occurs out-of-doors. It also occurs on Apricot, Nectarine, and Vine, rarely on Plum.

The adult female insect is dusky yellow at one time, then becomes dark brown, pale in the middle with dark transverse bands, oval and hemispherical in form; later, she becomes reddish brown. Eggs are laid about the middle of May, and the larvæ hatch under glass in mid-June. One female lays as many as 2000 eggs. No male is known in this country. The ova produce yellow to pale-red larvæ which may become later greenish or pale red, and which emit very long fine glass-like filaments from both ends. These wander about and at last fix upon a definite abode and grow into the adult female scale insects. They mainly occur on young wood, and there they produce discoloration and the shoots may die away.

TREATMENT consists of winter spraying with caustic alkali wash and spring treatment with paraffin emulsion.

Other Peach Pests.—Winter Moth (*Cheimatobia brumata*), Peach Blossom Moth (*Thyatira batis*), Cushion Scale (*Pulvinaria vitis*), Peach

Aphis (*Aphis amygdali*), Cherry Black Fly (*Myzus cerasi*), Red-legged Weevil (*Otiorhynchus tenebricosus*), Red Spider (*Tetranychius telarius*).

Ants and wood lice must be rigorously destroyed or they will damage much fruit. [F. V. T.]

APRICOTS

It may safely be affirmed that this fruit deserves more attention from growers who have walls than it has hitherto received. That there is a demand for it on the English market is evident from the large quantity imported from our southern neighbours every summer. The Apricot will do on walls with a south or south-westerly aspect; easterly is not so good for them. The remarks made as to planting for Peaches also apply to the Apricot.

The pruning is done, however, on a different system. Instead of laying in small shoots to cover the wall, as with Peaches, the summer growths must be cut back in July or early August to four or five eyes, so as to form spurs, as is done in Pears on the wall.

These spurs will, in course of time, become ungainly, and project some distance from the wall; then they must be carefully cut back a few at a time. The tendency can be checked by judicious disbudding.

The Apricot, like the "Prince of Wales" Plum, has a wicked habit of losing its most promising branches from no apparent cause. No remedy for this, nor indeed the cause of it, has yet been discovered, though Mr. Bunyard recommends root pruning for the first four or five years after planting.

Apricots that are designed for table use (and none other are worth wall culture) must be as rigorously and carefully thinned as Peaches or Nectarines. It is well not to do all the thinning at one time, but to go over the plant two or three times. The last thinning, just after stoning, will give fruit worth cooking. [W. G. L.]

The following varieties are mostly good croppers and of fine flavour:—

Breda.—Ripe mid-August. Small, roundish, deep orange-yellow flushed with red.

Hemskerk.—Ripe end of July. Large, roundish, yellow flushed with red.

Moorpark.—Ripe end of August. Large, roundish, irregular, yellowish flushed deep orange and brownish-red.

New Large Early.—Ripe mid-July. Large, oval, whitish, sometimes dotted and faintly flushed with red.

Oullin's Early Peach.—Ripe end of July. Large, yellow flushed with red.

Peach or Gros Pêche.—Ripe end of August. Large, oval, pale yellow faintly flushed with red.

St. Ambroise.—Ripe mid-August. Large, pointed, deep yellow flushed red.

Shipley's or Blenheim.—Ripe end of July. Large, oval, deep yellow.

SECTION XXIII

Small and Bush Fruits: Gooseberries, Currants, Raspberries, Strawberries, &c.

GOOSEBERRIES

§ 1. GENERAL

The Gooseberry is a first cousin of the Currant, and belongs to the same genus. It is derived from *Ribes Grossularia*, a spiny-stemmed shrub indigenous to the north of England, but also found in Europe, North Africa, and Western Asia.

As a market-garden crop it is of the utmost value, and is one of the fruits that can be picked and sold in all stages of growth once the fruits have attained the size of a finger nail.

Gooseberries are grown chiefly in England, probably 16,000 ac. being devoted to their culture, the largest centres of the industry being in the counties of Kent, Worcester, Cambridge, Middlesex, and Norfolk. There are probably 800 ac. of Gooseberries in Scotland, and 770 ac. are given as the acreage for Ireland. Unless the industry is crushed out by regulations in regard to the American Gooseberry Mildew, there is no reason why such an easily grown and generally profitable crop as gooseberries should not be considerably extended in the cooler parts of the kingdom.

Assuming the capital outlay for bushes and the annual expenses to be about the same for Gooseberries as for Red Currants (see p. 154), and the crop to average about 4 tons to the acre, the annual receipts and expenses (excluding rent and rates) per acre would work out as follows:—

RECEIPTS				EXPENSES			
4 tons at £10 per ton =	£40	0	0	Expenses	£15	0	0
				Balance	25	0	0
	£40	0	0		£40	0	0

There are probably 18,000 ac. of Gooseberries in the United Kingdom, with an annual crop of about 72,000 tons, the value of which would be about £720,000. [J. W.]

§ 2. CULTIVATION

The Gooseberry may be planted in the open as a full crop, or among top fruit as an under crop. It is safe to plant a greater breadth of Gooseberries than of either Currants or Raspberries because of the increasing use that is made of the fruit when unripe. Its season lasts from middle May to early August. If planted in the open, the distance for strong-growing varieties should be 7 ft. 6 in. by 6 ft.; and for less-vigorous varieties 6 ft. by 5 ft. Under trees the distance must be governed by that at which the trees are planted, but the spaces should not be less than those mentioned above. In purchasing bushes it is well to have them with 8 to 9 in. of clear stem before the branches start; the Gooseberry is always inclined to droop its branches, especially when a weight of fruit bears them down. It is well to leave cutting the tops until the year after planting, when they can be cut back hard to outside buds. As the bush grows it should be trained so that the branches radiate from the centre. Crosspieces should be taken out, but after the third year no topping should be done. The object in training a Gooseberry bush is to encourage the formation of white wood and leave clear spaces unobstructed by cross wood for the hand of the gatherer. If the growth is too luxuriant and free, plenty of phosphates and potash should be used. Soft, sappy growth is very liable to contract the American Gooseberry Mildew. As an additional precaution against this, spraying as late in the spring as it is safe, before the buds cast their winter sheath, with sulphate of copper 1 lb. to 25 gall. water, has been found useful. Another enemy of the Gooseberry is the Sawfly caterpillar. This pest spreads very rapidly, and if unchecked will soon defoliate every bush, destroying all chance of a crop the next year, besides seriously menacing the life of the bushes. The Sawfly caterpillar usually makes its appearance in May. The eggs can be seen on the ribs of the leaves in the lower parts of the bush; from these little black larvæ soon hatch out and commence feeding on the leaves, which they rapidly reduce to bare ribs. There must be several broods in a year, and the damage they can do is enormous. Various methods of checking them are adopted. Some growers say they find casting fine grit sharply into the bushes, so as to knock the caterpillars off, sufficient; some use Hellebore powder with a Torpille machine; some spray with a poisonous fluid. Whenever the pest appears, energetic measures must be taken to combat it, and the safest is to spray with something poisonous enough to kill the caterpillars. The soil should also be hoed as often as possible, to bring the pupæ up for the birds.

Sometimes Red Spider attacks the plants. This will happen mostly in cold backward springs. The evidence of the presence of the pest will be a paling of the tint of the leaves, which will take on a transparent appearance and show signs of browning at the edges. If the under side of the leaves is carefully scanned, minute red dots will be seen; with a moderate magnifying glass, that these dots are spiders will be clear.

To get at this pest it will be necessary to spray the under side of the leaves. The nozzle must be turned up and held at the bottom of the bush. A good poisonous spray that is not injurious to foliage must be used here also (see p. 147).

Although a good many varieties of the Gooseberry figure in the catalogue of the nurseryman, the number of them that are worth planting for market purposes is small.

May Duke or **May Queen** (the names seem synonymous for the same berry) is the earliest for picking. This variety does best in sheltered positions on warm soil. The fruit is of a light-green colour and swells quickly. In favourable situations it is big enough to pick green at the end of May. When ripe it is red in colour.

Lancashire Lad.—A red berry when ripe, of elongated shape and medium size. The bush does not grow to a great size. It is useful either for green or ripe picking.

Whinham's Industry.—A berry very much like the one just referred to. The bush grows to a greater size, and it comes into full bearing very quickly, but does not seem to stand as long. The fruit is smoother than the last, slightly larger, and does not ripen such a red colour.

Crown Bob.—A strong-growing bush, with fruit medium to large. Not quite such a free bearer as the two varieties just mentioned. It ripens very slowly, retaining its green colour longer than any other red variety. For this reason it is very useful, because it can be used for "green" work when other red sorts have put on too much colour.

White Lion.—Bush growing to a great size; fruit very large, white, almost transparent when ripe; sweet in flavour. A very prolific variety, bearing fruit in double rows along the shoots. A variety very much grown in Middlesex. The fruit can be sold for green later than any other. At first the berries are of a dark-brown tint near the stalk, so that they cannot be picked so early as other varieties. This brown discoloration goes off in June.

Other market-garden varieties are Crown Bob (red), Keepsake (yellow), Monarch (deep red), and Whitesmith (white).

Gooseberries cost about £4 per 1000 to buy. Planting will cost about 1*s.* 6*d.* per 100. The bushes will come into remunerative bearing on the fourth or fifth year. Pruning for full-grown bushes costs from 34*s.* to 40*s.* per acre. Cultivation will depend upon the system of cropping followed. A full crop of Gooseberries, with nothing between, will cost £3 an acre to keep clean; if, however, intercropping is practised, then the cost depends upon the nature of the crop introduced, and how much of the cost can be set to the debit of that crop. Picking costs from 1*s.* per half-sieve, when the fruit is small at the commencement, to 4½*d.* and 3*d.* when they are full grown and there is a good crop. Prices vary over a considerable range, depending, as to green berries, upon the crop in other places, and as to ripe berries, upon the price of strawberries and raspberries as well as upon the crop of gooseberries. From £9 to £14 per ton may be taken as the usual range of price for green berries, and from £6 to £9 per ton for ripe. An average crop of full-grown berries would be about 3 or 4 tons per acre. [W. G. L.]

§ 3. INSECT PESTS OF THE GOOSEBERRY

Gooseberry and Currant Sawfly (*Nematus ribesii*).—Gooseberries, and sometimes Currants, are attacked by Sawfly larvæ. The commonest of these is *Nematus ribesii* (fig. 373). Sawfly larvæ are easily told by the number of their legs, there being six jointed ones in front and five pairs of prolegs, and in addition an anal pair. The larvæ usually assume all manner of curious positions on the bushes.

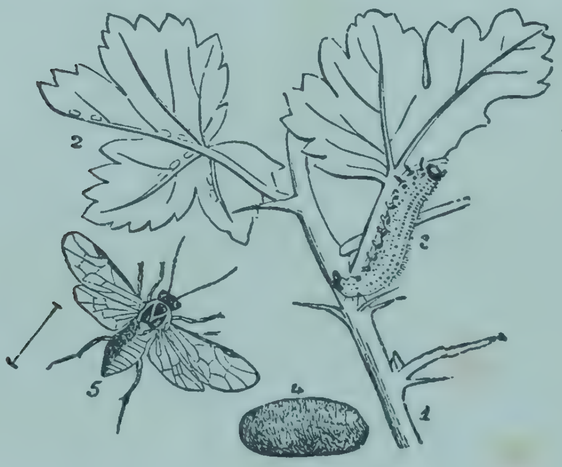


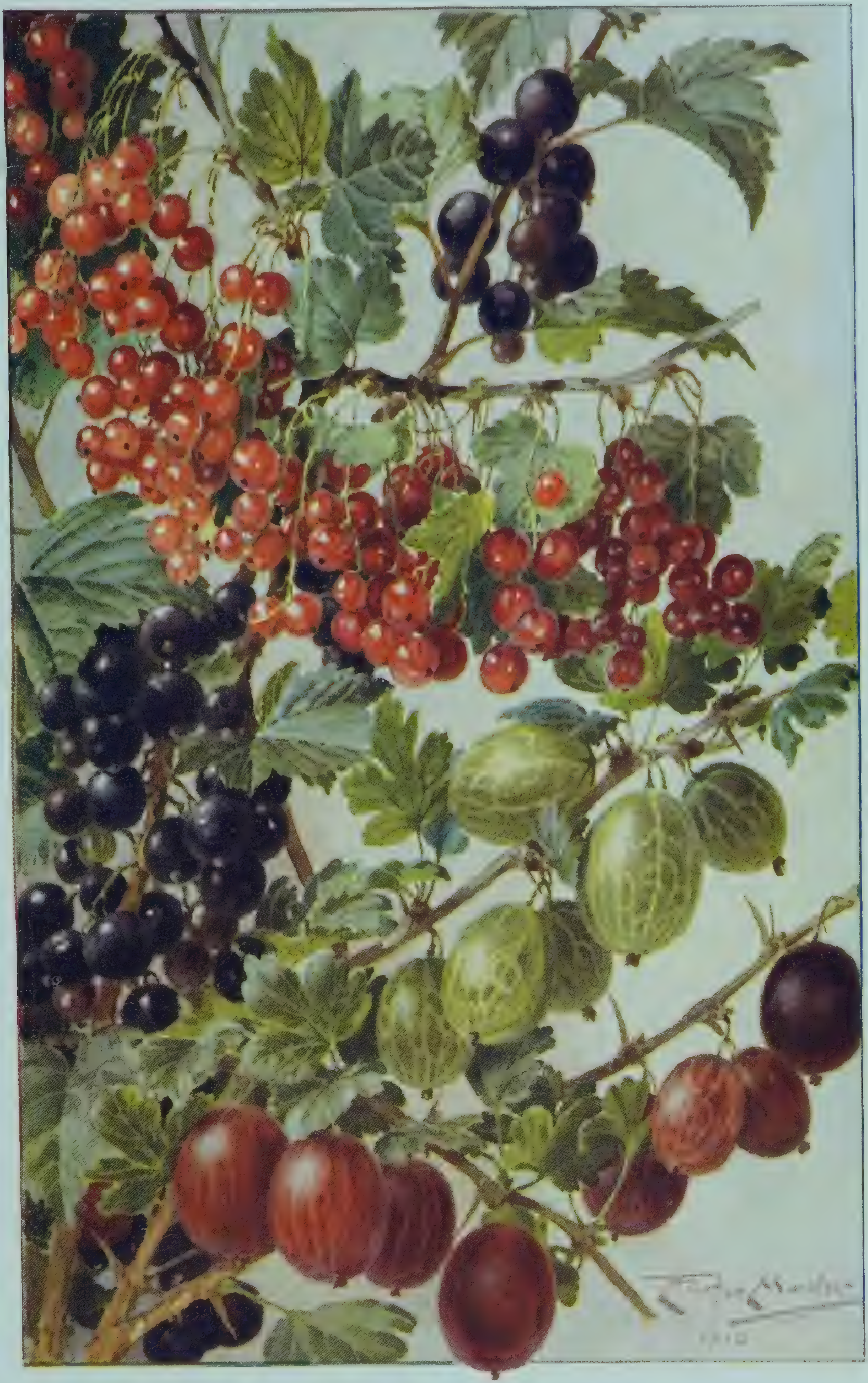
Fig. 373.—Gooseberry and Currant Sawfly (*Nematus ribesii*)

1, Shoot of gooseberry. 2, Eggs. 3, Larva. 4, Pupa. 5, Perfect insect.

The adult female Sawfly is about $\frac{1}{3}$ in. long, almost orange, with dark head, and most of the thorax dark; the legs yellowish, except the tarsi, which are brown; the four wings are transparent and iridescent. In the male the thorax is nearly all black, except a yellow band in front, abdomen dark, except the apex and the sides and venter, which are yellowish. The adults occur in April and May, and lay their eggs in small slits on the under sides of the leaves. The egg stage lasts from five to twelve days. The larvæ are green spotted with black, the first and part of the second segment and the last two orange yellow. When full grown, they reach nearly $\frac{2}{3}$ in. long. At first the larvæ eat round holes, then the edges of the leaves, and later the fruit may be attacked. When mature they fall to the ground and pupate in a silken case covered with earth; the pupal stage lasts ten to twenty-one days in the summer. The last brood that fall to earth do not pupate until the following spring.

Treatment.—Spraying with hellebore or dusting with the same was the old remedy. We now know that nicotine wash or paraffin emulsion will as easily kill the larvæ, especially when young, but also up to at least two-thirds of their growth, and this is recommended especially where the fruit is going to be picked green. Even soft soap and quassia wash will kill them.

The Gooseberry Red Spider (*Bryobia nobilis*).—The Red Spider of the Gooseberry is frequently very harmful. It is distinct from others we find



RED CURRANT, "Raby Castle". BLACK CURRANT, "Boskoop Giant"
GOOSEBERRY, "Whitesmith" and "Whinham's Industry" (red)

on Ivy, and Apple, and Peach. This acarid attacks the buds and young leaves, stunts their growth, and produces a curious dull mottling of the leaves.

The Gooseberry Red Spider belongs to the genus Bryobia, which differs from Tetranychus, the Red Spider of the Vine, &c., in that its first pair of legs are longer than the other three pairs. The mites of this genus spin no webbing of silk. The damage is done by the mites constantly sucking the sap from the leaves. In colour this acarus is very variable. Some are grey, others greenish, others rusty red, others leaden grey or bright red; the legs are pale or dull reddish. In size the mature specimen may reach about $\frac{1}{30}$ in. During dull weather, in early spring, they collect in crevices on the wood and under the rind upon it. In this manner they may be seen in February, and usually of a rich red colour. When it becomes warm and sunny the acari crawl about and feed on the buds and young leaves. Later, when the leaves are older, they are found mainly on the under side of them. As soon as it becomes dull, or turns cold, they take shelter at once, and also return to shelter at night, In late March, but usually in April, they start laying shiny red globular eggs on the wood, bases of thorns, and between old bud scales.

These eggs hatch in four or five days into small six-legged transparent acari—the larval Red Spiders. After moulting three times, they are ready to breed again at the end of fourteen days. The winter seems to be passed in both the egg and immature condition.

PREVENTION AND TREATMENT.—The old remedy for Red Spider was liver of sulphur, at the rate of 3 to 5 oz. to 10 gall. of water. Now paraffin jelly is found to be much more effectual. This is made by boiling 5 gall. of paraffin and 8 lb. of soft soap together, and whilst boiling add 1 pt. of cold water and then well stir. This becomes a jelly on cooling, and can be used at the rate of 10 lb. to every 40 gall. of water.

Other Gooseberry Pests.—The Currant Clearwing (*Ægeria tipuliformis*), Magpie Moth (*Abraxas grossulariata*), Dot Moth (*Mamestra persicariæ*), Winter Moth (*Cheimatobia brumata*), Clay-coloured Weevil (*Otiorhynchus picipes*), Black-bodied Sawfly (*Nematus appendiculatus*), Gooseberry Emphytus (*Emphytus grossulariata*), Gooseberry Aphis (*Aphis grossulariata*), Currant Aphis (*Myzus ribis*), Brown Scale (*Lecanium persicæ*, var. *sarothamni*). (See also Vol. I, p. 166 *et seq.*) [F. V. T.]

§ 4. DISEASES OF THE GOOSEBERRY

American Gooseberry Mildew (*Sphærotheca mors-uvæ*).—I first announced the occurrence of this dreadful parasite in Europe in the *Gardeners' Chronicle*, 25 August 1900 (fig. 374). The specimens were sent by Mr. (now Sir) F. Moore, F.L.S., and were obtained from County Antrim. Soon after this announcement was made the hue and cry commenced, and no political partisan ever succeeded in making more capital out of a point than was attempted to be made out of the advent on European shores of the American Gooseberry Mildew. According to various authorities, and for divers reasons, the fate of the British Empire has frequently hung in the balance, and only required the final tip, which happily never was administered, to send it headlong to destruction, but never before was the Empire so near the verge of destruction, as when this parasite made its home amongst us. The mildew is admittedly a very serious scourge to Gooseberries, and it was extremely impolitic, to say the least, of a person supplicating for the presence of the said disease only a few years after its advent, in order that it might reduce the quantity of gooseberries, which on account of an exceptionally good crop throughout the country, could not be sold at a profit. Soon after its occurrence in Ireland it appeared in considerable abundance in Worcestershire in the Evesham district, and a small amount was met with on one standard Gooseberry on a *Ribes aureum* stock in Kent. At the present day the mildew occurs in various districts in England, being especially abundant in the neighbourhood of the Wash. American Gooseberry Mildew has also appeared on the Continent, in Norway, Sweden, Denmark, Germany, Hungary, and Russia. It has been stated that the disease was introduced into Ireland and the Continent from

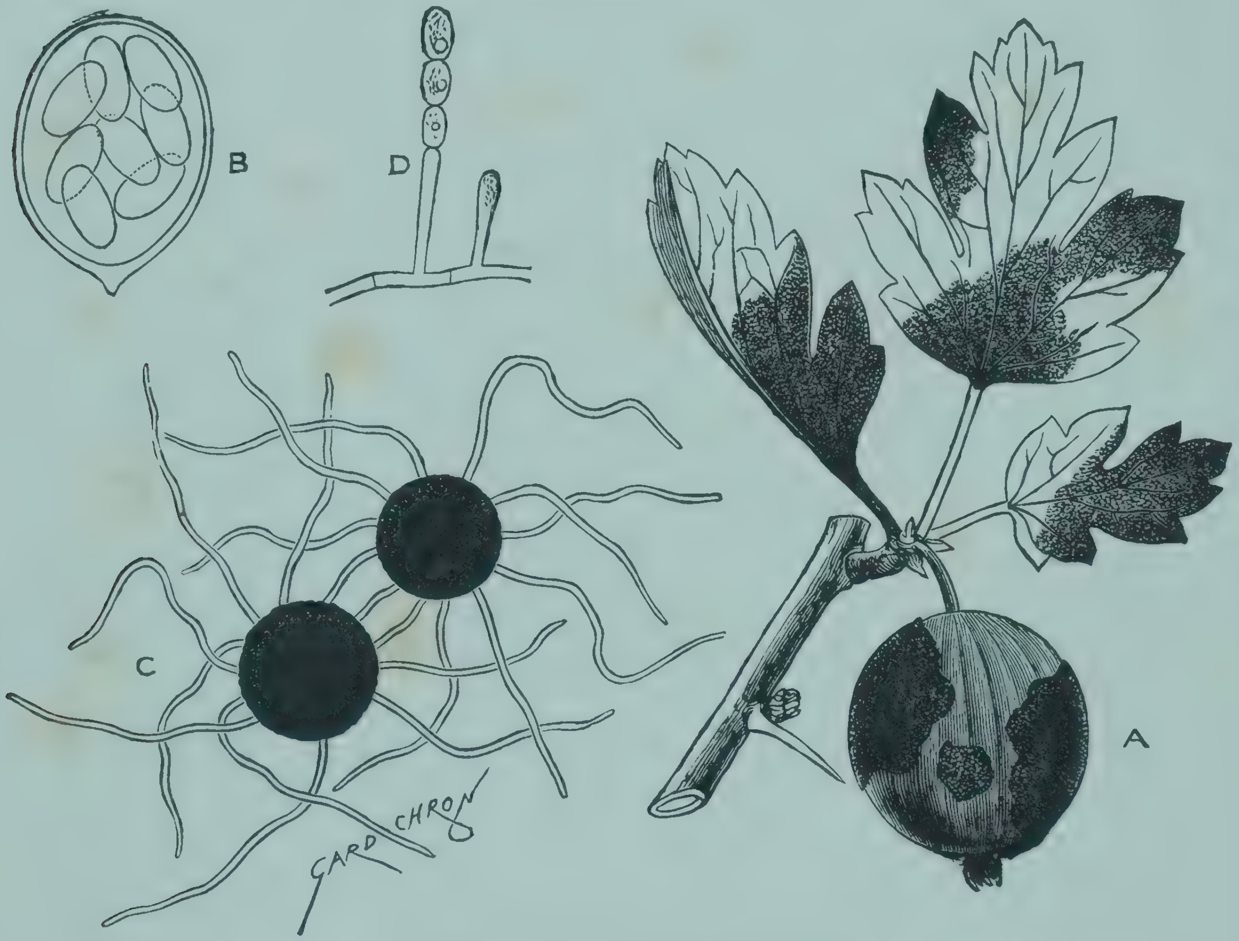


Fig. 374.—American Gooseberry Mildew

A, Leaves and fruit attacked (nat. size). B, Ascus from winter fruit containing 8 spores, × 400. C, Perithecia or winter form of fruit, × 150. D, Conidial or summer form of reproduction, × 200.

America. As the mildew is a native of the United States, this statement may be quite true, but it lacks evidence. It has also been stated that the mildew came to England from the Continent, but out of a batch of standard Gooseberry bushes imported at the same time, only one showed a little mildew, and that only after it had been in this country for some time, so that the evidence is not convincing. The batch of Gooseberries in the Evesham district, where the mildew was first observed in England, were not imported, but raised on the spot. In the United States the mildew is not uncommon on the native Gooseberries, but does not assume the proportions of an epidemic; but it attacks European species so virulently that they cannot be cultivated at a profit. The mildew has also been met with sparingly on Black and Red Currants in this country. There is nothing unusual in the behaviour of American Gooseberry Mildew. Epidemics, that is severe outbreaks of a disease, are practically unknown, except under very exceptional circumstances, among the indigenous plants of any country. Such have grown along with the parasitic fungi, also indigenous, for such a long time, that they have become accustomed to each other, and neither can take any great advantage of the other. On the other hand, when you introduce a plant into a new district, it often suffers severely for a time. The same is true when a parasitic fungus invades a new country, as in the present instance; at first it simply runs riot with those plants it can attack, but gradually loses its virulence. When the Hollyhock Rust first invaded this country, it rendered the cultivation of Hollyhocks practically impossible for a time. The rust is yet with us, and will probably remain, but it has found its level, and Hollyhocks are grown in abundance. (See Vol. II, p. 54.)

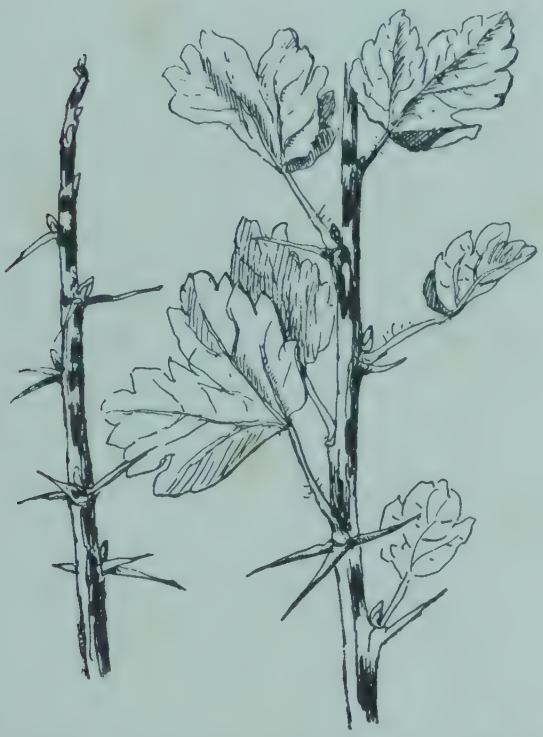


Fig. 375.—American Gooseberry Mildew. Appearance of afflicted shoots in September

The American Gooseberry Mildew first attacks the tips of the young shoots, rarely extending backwards for more than a few inches; it soon afterwards appears on the fruit. It first appears as a pure-white, thin mildew, much resembling in general appearance the European Gooseberry Mildew. The mildew soon becomes powdery, due to the formation of summer spores, which are scattered by wind, birds, insects, &c., and infect adjoining plants, on which the mildew soon appears and produces summer spores, which infect other plants, and thus the disease spreads with great rapidity unless promptly checked. Soon after the summer spores have been scattered, the mildew changes to a dull-brown colour, and becomes thicker in texture, more especially on the twigs and berries; in fact, the patches of mildew become so thick and felty that they can be readily scraped off. Later in the season the felt-like patches of mould become studded with small black fruits resembling in size the winter fruits of the European mildew. Some of these remain attached to the mildew on the twigs until the following season, others fall to the ground, but in both instances the spores are liberated in the spring, and are capable of infecting the young shoots of Gooseberries.

The preventive measures that have proved most satisfactory in combating this disease are as follows. Commence spraying with a solution of potassium sulphide (=liver of sulphur) 1 oz. in 3 gall. of water, just when the leaf buds are expanding, and repeat about every ten days, or more frequently if heavy rains occur. This method is adopted as a means of preventing the spread of the disease by means of summer spores. With the object of eradicating the disease, a different line of treatment should be pursued. Somewhat early in the autumn every shoot should be pruned back for at least 6 in. This practically removes all the shoots bearing mildew and winter fruit of the fungus. In some places the prunings are dumped in heaps to be disposed of at some convenient time. In other places the prunings are not collected at all, but left lying on the ground around the bushes. The prunings should be collected and burned at once. The time to prune is somewhat difficult to determine. If it is done too early in the season, and is followed by mild weather, new shoots are sometimes made which may become infected, and so carry over the disease to the next season. If pruning, on the other hand, is unduly delayed, many of the winter spores drop to the ground, and, unless due precautions are taken, endanger the bushes for the following season. This can be guarded against by digging over the ground during the winter, by which means all winter fruit of the fungus, whether lying on the ground or on fallen diseased leaves, are buried and rendered harmless. In places where the methods outlined above have been honestly carried out, the disease has been reduced to a minimum, or altogether banished.

European Gooseberry Mildew (*Microsphæra grossulariæ*).—This is a white superficial mildew, appearing on the leaves, and sometimes—but rarely—passing on to the fruit. It grows on both surfaces of the leaf, and forms a very thin film which remains permanently white. Soon after the appearance of the mildew its surface becomes minutely powdery as if sprinkled with flour. This dusty appearance is due to the presence of myriads of the summer form of fruit, which are conveyed by various means to adjoining bushes, and thus the disease spreads apace unless checked.

At a later stage minute black bodies, smaller than the head of a small pin, may be seen scattered over the surface of the white mouldy patches. These are the winter form of fruit, which remain on the dead leaves until the following spring, when the spores are liberated and infect the young leaves.

This is not considered as a serious disease, at all events in Britain, and but rarely does real injury to the plants attacked; but as so many diseases, usually insignificant, suddenly, for some unknown reason, become destructive parasites, it is wise to arrest their development.

Spraying with half-strength Bordeaux mixture, or with a solution of potassium sulphide, on the first appearance of the mildew, will arrest its spread. Presumably the ground under the bushes will be turned over during the winter. This will bury all dead and infected leaves, otherwise there will be a possibility, or almost certainty, of infection the following season.

Gooseberry Collar Rot (*Sclerotinia fuckeliana*).—This is a very destructive and widely diffused disease, but with prompt attention can readily be detected and checked in its career. Gooseberries are most frequently attacked, although Black- and Red-currant bushes sometimes show the disease. The most usual symptom of the presence of this parasite is the sudden wilting of the foliage of a branch, or sometimes of the entire bush. This may occur soon after the leaf buds have expanded, or later in the season when the bush is in full leaf.

The conidial form of the fungus, called Botrytis, is responsible for the mischief done, the higher or Sclerotinia stage being rarely, if ever, produced, at least in this country. The fungus is a wound parasite, and enters the stem at the collar through some small wound. When once in the tissues the mycelium spreads in the bark and wood. If it completely girdles the stem the whole bush dies; but more frequently it attacks one main branch at its base, and when the mycelium of the fungus has increased to such an extent as to cut off the supply of water taken up by the root, wilting, followed by the death of the part affected, is the result. Soon after the wilting of the leaves, tufts of a grey or mouse-coloured mould burst through the bark at the base of the diseased branch, which, if not soon removed, will gradually become covered with the mould or Botrytis form of the fungus. If the diseased branch is promptly removed the remainder of the bush may continue to flourish, although so far as my own experience is concerned this is not the case; the mycelium from the diseased branch having spread into adjoining parts, and year by year additional branches die. Taking everything into consideration, I think the most economical course is to remove and burn the bush when once it is clearly established that it is infected. Diseased bushes should be burned at once, for in addition to the great number of Botrytis spores that would continue to be produced on the dead wood, numerous small black bodies termed sclerotia develop on the dead bark. These eventually fall away and give origin to Botrytis spores.

Young shoots are also often attacked, and die back for some distance, hence the popular name of "Die-back" amongst market gardeners. It is well to remove and burn all such as soon as observed, to prevent further infection.

Finally, the leaves and also the fruit are sometimes injured by the same fungus, which often follows Red Spider or green fly. The leaves that are attacked often bleach, and have a silvery look round the edge. The berries show a brownish stain, which finally becomes soft and covered with the mould.

Prunings should not be left under the bushes, neither should they be left in heaps here and there to rot. All such accumulations form centres of disease, from which the fungus spores are diffused in myriads by wind, birds, &c.

Where the disease has previously existed, the bushes, and also the ground, should be thoroughly drenched with a solution of sulphate of copper during the winter months, before the leaf buds expand. This should be followed by a spraying with half-strength Bordeaux mixture just when the fruit is set.

Gooseberry- and Currant-leaf Spot (*Pseudopeziza ribis* = *Glœosporium ribis*).—This disease is very prevalent on the leaves of both Gooseberries and Currants, but is generally neglected, as its significance is mostly unknown to growers, or it is mistaken for the work of "green fly". Leaves that are attacked—and as a rule every leaf on a bush is attacked when the fungus once gains a foothold—fall early in the season during a severe attack. This not only checks the full development of the fruit already present, but also unfavourably affects the crop of the following season, on account of the imperfectly matured wood. This disease is confined to the leaves, and its presence is indicated by the appearance of numerous very small warts, most abundant on the upper surface of the leaf, which commences to turn yellow soon after being attacked. If allowed to run its course the fungus spreads rapidly, the spores from the leaves first diseased being spread by wind, rain, insects, &c., to adjoining healthy leaves. If the bushes are sprayed with half-strength Bordeaux mixture, or with potassium sulphide, when the disease first appears, its spread will be arrested. This is certainly worth doing, as the disease saps the vigour of the bushes to a serious extent.

It is important to remember that when the leaves have fallen the bush is perfectly free from disease, and will remain so unless infected afresh. Such infection proceeds from the old fallen leaves the following spring; hence if the leaves are dug in during the winter, or got rid of in some way, the disease will not reappear.

Black Knot (*Plowrightia ribesiæ*).—This disease is met with most frequently on Gooseberry bushes, although it sometimes occurs also on Black- and Red-currant bushes. The first indication that something is going wrong is the wilting or yellowing of the leaves, which commence to fall early in the season. This condition of things may continue for two or three years before the bush dies. Sometimes only a single branch shows these symptoms, when a careful examination of the lowest portion of the branch will reveal the presence of numerous short, transverse, gaping cracks, 1 to 2 lines in length, each crack being filled with a jet-black substance, which is the fruit of the fungus. If only a single branch is attacked it should be cut away as close as possible to the part from which it springs. Burn the diseased part that is cut off. If the whole bush shows signs of wilting it is doomed, and should be removed and burned, as a cure is impossible; and it is not only waste time, but endangering neighbouring bushes, to allow an infected bush to remain, as the mycelium of the fungus is deeply embedded in the tissues of the bush some time before it shows the first signs of wilting.

The fungus is a wound parasite, and probably the spores often gain an entrance into the tissues through wounds made by aphides (green fly) or scale insects. [G. M.]

CURRANTS

§ 1. GENERAL

The three principal kinds of cultivated Currants have been derived from two distinct species, both natives of the British Islands, but also found in a wild state in Europe, temperate Asia, and North America. The Red and White Currants are descended from *Ribes rubrum*, while the Black Currant comes from *Ribes nigrum*. They are not to be confused with the currants of the grocers' shops, which are the dried fruits of a small-fruited seedless variety of Grape Vine from the neighbourhood of Corinth.

Although belonging to the same genus, it is well known that they are quite different in their vegetation. The Red and White Currants produce their flowers and fruits in spurs or clusters on the wood from two to seven years of age, and just at the base of the one-year-old wood. The Black Currant, however, never produces its flowers or fruits directly from the old wood, but from the young shoots of one season's growth. These peculiarities are of some practical importance from the pruner's point of view.

It is impossible to give with any accuracy the total area under Currants in the United Kingdom, as the Board of Agriculture and Fisheries Returns unfortunately have lumped Gooseberries and Currants all together. The Department of Agriculture and Technical Instruction for Ireland, however, have kept Gooseberries, Red and White Currants, and Black Currants distinct from each other; and from the 1908 returns we find that 183 ac. are under Red and White Currants, and 265 ac. under Black Currants in Ireland—almost a negligible quantity.

The total acreage under Gooseberries and Currants in Great Britain is given in the 1911 Returns as 27,557 ac., of which 1227 ac. are in Scotland, and 129 ac. in Wales. Of the 26,150 ac. in England it may be assumed that about one-third would be under Currants of all kinds, or say about 9000 ac. altogether. It is probable that Kent, Worcester, Cambridge, Middlesex, and Norfolk are the largest Currant-growing counties in the British Islands.

Assuming Red Currants (and White) to be planted 5 ft. by 4 ft. apart, an acre will hold about 2178 bushes. When these are all in bearing, say from the third and fourth year onwards, a fair average crop for each plant would be about 4 lb. of fruit per bush, or nearly 4 tons per acre. The expenses and receipts of an acre of Red Currants may be set out as follows:—

CAPITAL OUTLAY

2178 bushes at £4 per 1000, say	=	£8	0	0
Planting same at 1*s.* 6*d.* per 100, say	=	1	13	0
Capital outlay apart from rent, preparing ground, &c.		£9	13	0

ANNUAL EXPENSES

Pruning	£1	10	0
Cultivating	3	0	0
Picking 4 tons at 35*s.* per ton	7	0	0
	£11	10	0

It will thus be seen that the first year's expenses will be at least £21, 3*s.*, without reckoning rent, rates, and taxes. As the crop will not commence to be remunerative until the third or fourth year, the annual expenditure of about £12 will have to be met by receipts from saleable vegetable crops.

Taking the average crop to be 4 tons per acre per annum, and the average price at £9 per ton (about 1*d.* per pound), the gross receipts would be £36 a year. Deducting the cost of pruning, cultivating, picking, and marketing, say £15 altogether, a balance of £21 would be left, and out of this rent and rates would have to be paid.

The Red-currant crop of the British Islands is probably about 30,000 tons annually, representing, say, £270,000. In the year 1908 the declared value of imported currants of all kinds was £121,852. [J. W.]

Red Currants.—These form a very important item in the bush fruit of a market garden. The variety of uses to which the fruit is put gives it a wide range of usefulness and occasions a demand for it in large quantities. Soil that will grow top fruit will readily carry Red Currants. That is to say, they may be cultivated in any soil that is not waterlogged or too clayey for ordinary cultivation, or that is not too stony or chalky to carry ordinary farm crops.

Red Currants can be planted closer than Gooseberries. Generally speaking, the best distance apart is 5 ft. by 4 ft. The young bushes should have a stem of at least 9 in. long; this will check the growth of suckers, and keep the fruit from the splashing of soil during heavy rains.

The system of pruning Red Currants is based on the knowledge of the fact that fruiting buds form round the base of the previous year's growth and on the older wood. The best form for a Red-currant bush is that of five main shoots springing from the centre stem in the form of a cup. The main shoots each year should be pruned to the third or fourth bud, always selecting an outside bud. All the laterals should be cut back to within 1 in. of the stem. The fruit will be found to come round the base of each of these laterals.

In some places there has grown up a practice of leaving Red Currants to grow uncut; it is claimed that they crop more heavily. The practice has as much to recommend it as any other "do nothing" policy has. It saves trouble and provides an excuse for cutting down the wages bill. The test of experience proves that the fruit loses in colour and size; the bushes become lanky and flop about, so that the fruits are mostly on the ground, splashed by every rain, and made an easier prey for the birds.

It will be found well to defer topping the main shoots till as late as possible in the spring, because the little blue tit, in hard weather, has a fondness for the buds of the Currant and Gooseberry, and he may choose just the bud left to form next year's main shoot, which will spoil the plan; but if the topping is not done till late the damage he has done can be seen and discounted.

The Red Currant is liable to the attack of a fungus which shows itself in red spots which form on decaying wood. All dead wood should be cut off and quickly burned.

The only other pest of a serious nature to which the Red Currant is subject is the Currant Aphis. This will in bad cases cause the leaves to curl up and the currants to be covered with brown deposit.

Spraying early with poisonous spray fluid that does not injure the foliage will prevent the attack being serious.

Small birds are very fond of the Red Currant, and some growers spend money and trouble during the fruit season in keeping men with guns to scare them away. It may be doubted whether in the case of bush fruit there is any return at all for such outlay. It drives the birds from one part of the garden to another, it is true, and probably increases their appetite with exercise. The time to keep the bird pest in hand is the winter.

Red currants will begin to bear the third year. The cost of plants is a little less than that for Gooseberries. The selection of sorts is small. The old "Red Dutch" is still largely grown, but "Enfield Long Bunch" is better. For late work "Raby Castle" is good. (See Coloured Plate.)

Expenses and Receipts.—The cost of pruning Red Currants is about the same per acre as Gooseberries. The cost of picking is generally 6*d.* per half-sieve, the average crop 3 to 4 tons per acre, and the price variable from £6 to £12 per ton. If the grower is near a good market and can get some selected large fruit put up in punnets or pecks for table fruit, he can thereby considerably increase his average of price. The cost of cultivation would be the same as for Gooseberries, and the remark there made as to intercropping will also apply (see p. 145).

White Currants.—There is very little demand for this fruit. Near a large centre a few punnets of selected fruit can be disposed of at good prices for table purposes, but a few bushes at the end of a row would produce enough for it. The cultivation, pruning, and treatment would be the same as for the Red Currant.

Black Currants.—This is a much more important item in the fruit garden than either Red or White Currants; its uses, both for culinary and medicinal purposes, ensure for it a wide demand, although the ravages of the "Big Bud" have materially lessened the area of culture.

Black Currants like a strong soil, and will do well in land too stiff for most other kinds of fruit. Plants can be bought at the same price as Red Currants, that is £3 to £4 per 1000. A guarantee should be obtained that they are free from "Big Bud".

The old system of planting was to put the bushes 7 ft. by 6 ft. apart, putting them well down in the ground so as to encourage sucker growths from the bottom. A new system is now being tried, and it is claimed with much success. It is to plant the bushes deeper still, so that the main shoots are well under the ground; the distance is 1 ft. from plant to plant and 2 ft. 6 in. from row to row. Every year the old wood is cut out, and only the young growths from the bottom left.

Black Currants fruit on the young wood, and it is claimed that by this means the "Big Bud" is cheated of its prey, because it is in wood of the second year's growth that it has the most opportunity of doing damage. The plan is worth the trial, but there has not been sufficient test of it yet to recommend it for widespread adoption.

The plan for pruning the bushes planted on the old style is to cut out the old wood back to strong young shoots, as soon as the bushes become thick, arranging so as to leave the bush open to light and air.

There are several varieties of Black Currant favoured by market growers, the preference seeming to run in localities, so that it would appear that some varieties do better in certain districts. Liability to, or immunity from, "Big Bud" are the chief governing factors in the selection or rejection of a variety however, so much has that terrible pest impressed itself upon the mind of the growing fraternity.

The price of late years has varied over a wide range; in 1909 they made £32 per ton. There cannot be the least doubt of their value as a crop if the "Big Bud" can be kept down. It must not, however, be taken as a conclusion that apart from this pest they are certain regular croppers—late frosts at critical stages of the blossoming period will destroy the crop prospect sometimes.

White Naples is an old variety with the reputation for heavy cropping, but in some places it has shown itself to be an easy prey to "Big Bud".

The Baldwin.—This is a red-budded variety, bearing medium-sized fruit, and a fairly good cropper. It seems to be less easy a victim to the "Big Bud" than the foregoing variety.

Boskoop Giant.—This is an importation from Holland. The bush is of vigorous habit, quickly attaining a great size. The fruit is very large and set wide apart on long bunches. The buds on the stems are formed with long spaces between them. On the whole it cannot be called a heavy cropper. It was claimed for this Currant that it was immune to the "Big Bud", but, alas! that can no longer be set to its credit. (See Coloured Plate.)

Lee's Prolific and **Carter's Champion** are each of them good varieties, and well worth planting. [W. G. L.]

§ 2. DISEASES AND PESTS OF CURRANTS

Magpie or Currant Moth (*Abraxas grossulariata*).—A large Geometer Moth (fig. 376), $1\frac{1}{4}$ in. across the wings, creamy white, spotted with black and some yellow on wings and body. Appears in August and September, and lays yellow eggs on the Currant, Gooseberry, and Hazel leaves. The eggs soon hatch and the small dusky looper caterpillars that come from them live all through the winter amongst dead leaves, in holes in walls, &c. In spring they come out and commence to feed on the young leaves, and by the end of June or July have reached over 1 in. in length, when they are creamy white spotted with black and with orange side markings. They are looper larvæ having only one pair of mid prolegs. When mature they spin a loose scanty cocoon and change to a black pupa with golden-yellow bands.

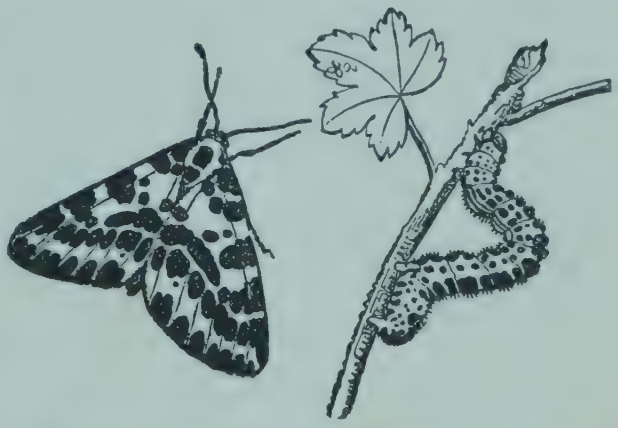


Fig. 376.—Magpie Moth (*Abraxas grossulariata*) and Larva

Treatment—Autumnal spraying with arsenate of lead to kill the young larvæ. Winter spraying to clear away sheltering places with caustic soda or spring spraying with arsenate of lead.

Currant Shoot and Fruit Moth (*Incurvaria capitella*).—A small Tineid Moth which lays her eggs in the immature Currant fruitlets, usually two in each. These turn to small larvæ which feed in the seed and cause premature ripening of the fruit. When quite small they leave the fruitlets and crawl to some crevice under the rind, &c., near a bud, and there in a flat grey cocoon they remain until next spring, when they emerge and enter the buds and later tunnel up the shoots, which flag and die. The moth appears from the pupa in the dead shoot in May; it is about $\frac{1}{2}$ in. in wing expanse, deep brownish with yellow marks on the front wings.

Treatment consists of winter spraying with caustic soda and hand picking the flagging shoots before the moths escape.

Big Bud (*Eriophyes ribis*, Nalepa).—The dreaded "Big Bud" in Black Currants is caused by small mites known as *Eriophyes ribis*, formerly *Phytoptus ribis.* (See Vol. I., p. 180, for figures of this and other Currant pests.)

These acari are elongated, with four legs only in front and a ringed body with a few bristles. They are scarcely perceptible to the naked eye, but may be seen with a lens, especially in bright light. At their tail end is a kind of sucker. They live almost entirely inside the buds of the Black Currant, but now and then attack the Red and the White. Their presence in the bud causes it to swell abnormally and become bloated or globular in form. Large numbers of mites may be found in a single bud, where they breed. The eggs are comparatively large. As the buds die the acari migrate to other buds; this they do by both crawling and jumping, holding on to the outside of the bud by the terminal sucker. Birds, bees, &c., also carry them about. The young are much like the adults. Reproduction takes place most of the year, but less in February and the winter months than at other times. Migrations are frequent, but most numerous from April to June. A few mites have been found under the skin of the stumps left in the ground; these probably enter the new buds or young shoots.

The mites may kill the buds, which then turn brown and remain on the bushes, or the buds may burst but then seldom bear fruit.

TREATMENT.—The only satisfactory method is hand picking; this must be done about three times, namely, in autumn, spring, and late spring, and the buds carefully burnt. Certain varieties resist the mite more than others. The "Boskoop Giant" and French Currants withstand it well as a rule, whilst "Black Naples" and "Baldwins" suffer very severely. No spraying has proved to be completely successful, but results of benefit have been claimed by spraying six or seven times with soft soap and quassia in spring and early summer, and with three dustings of lime and sulphur. It is best, however, to rely on hand picking.

Other Currant Pests.—The Currant Clearwing (*Ægeria tipuliformis*), Winter Moth (*Cheimatobia brumata*), Currant and Hop Pug Moth (*Eupithecia assimilata*), Currant-fruit Moth (*Spilonota roborana*), Currant and Gooseberry Sawfly (*Nematus ribesii*), the Glaucous Leaf Weevil (*Phyllobius calcaratus*), Currant-root Louse (*Schizoneura Ulmi*), Currant-leaf Blister Louse (*Rhopalosiphon ribis*), Currant-shoot Aphis (*Myzus ribis*), Brown Currant Scale (*Lecanium persicæ*, var. *sarothamni*), White Woolly Currant Scale (*Pulvinaria vitis*, var. *ribesiæ*). [F. V. T.]

For Fungoid diseases of Currants see p. 151, under Gooseberries.

RASPBERRIES

§ 1. CULTIVATION

The Raspberry (*Rubus Idæus*), after the Gooseberry, Currant, and Strawberry, constitutes one of the most important market-garden crops. It differs in growth considerably from all other tree and bush fruits in that it bears its fruit on stems or "canes" of one season's growth, which naturally die away in the winter, never to live again. As a rule the young canes when developing bear five leaflets, but the next year, when fruiting, only bear three leaflets.

According to the returns of the Board of Agriculture there are about 9000 ac. of Raspberries grown in Great Britain, by far the larger portion being in England (6679 ac.), Scotland having 2326 ac., of which over 1700 ac. are in Perthshire. The industry here has been dealt with in the article on "Fruit Growing in Scotland" at p. 33. In England the largest Raspberry-growing counties are Kent, 2291 ac.; Norfolk, 909 ac.; Cambridge, 648 ac.; and Middlesex, 328 ac. Yorkshire, Cornwall, Essex, Worcester, Devon, and Lincolnshire come next, varying from 222 ac. in the first-named to 149 ac. in the last.

Ireland is practically without Raspberries at present, only about 420 ac. being given for the whole country, while Wales has only 45 ac. of Raspberries to its credit. [J. W.]

Raspberries are surface-rooting plants that like light land, though they will not do better on thin soil that cannot hold some moisture than they will on land that is stiff and clayey. The method of planting is to place two yearling canes in a cut made by a spade, 18 in. apart in the rows and 5 ft. apart from row to row. The young canes should be cut down to 9 in. before growing time begins. During the summer they will throw up "spawn", i.e. young shoots, which become the fruiting wood for next year. For the first year these will be weak and bear little, but if the soil and cultivations are suitable they will become stronger and more numerous each year, until by the third year they are able to carry a crop of appreciable quantity. Raspberries like a good quantity of potash (see "Manures", Vol. I., p. 158), and pay for a topdressing of stable manure every fourth year. Do not dig among the roots more than is absolutely necessary.

The method of pruning is to cut out the last year's wood, thin out the young canes where too numerous to five or six, and then top according to strength of growth. Where the growth is vigorous, some system of tying the canes must be adopted, or else they will bend down with the weight of fruit, and it will draggle in the dirt. At Blairgowrie a system of strained wires is adopted, which has a very neat and workmanlike appearance, and, though of considerable initial cost, must last a long time, when once done, without further expense. Sometimes the canes are tied together in a bunch, on the principle that union is uprightness. Sometimes the canes are divided, and half from one stool is tied to half of the next stool, on the stand-together-or-fall-together principle. The system of growing Raspberries at Blairgowrie, in Perthshire, is described at p. 35.

The last two methods have the common disadvantage of bunching the canes together at the top, so that some must have difficulty in developing their fruit spurs. The Scotch plan has the advantage that the canes are tied singly along a wire, each being free to develop, and all being made secure against the brushing and swaying action caused by winds.

The gentleman's gardener plan of a stake and tie to each stool of canes is discarded on the ground of expense. Some growers cut the canes low enough to render them self-supporting. This can only be done without serious loss of fruit with certain varieties that grow a short stiff cane, such as Carter's Prolific or Steel's Victoria, and, to a less extent, Superlative.

The cost of canes is about £1 per 1000. The planting will cost about 1*s.* per 1000. The cost of cultivation will be the same as stated above for Currant and Gooseberries. The cost of manure on fairly good ground will be £4 per acre per annum. Pruning costs about 20*s.* to 25*s.* per acre. To this must be added the cost of tying if this should be necessary.

Steel's Victoria.—This is a slow-growing variety, requiring good soil and generous treatment, taking four or five years to come into full bearing. The fruit is large and conical. It is very early. Some fruit from this variety was sold last summer in Covent Garden at 3*s.* per pound.

Superlative produces canes of moderate vigour. The fruit is large and it is very prolific. It is early, but not so early as Steel's, though it comes into bearing quicker. Both this variety and Victoria are table varieties, and are not favoured by jam makers.

Carter's Prolific.—An old variety, with much the same characteristics as the Superlative, but not so good.

Antwerp Red.—The variety most favoured at Blairgowrie. Canes grow with considerable vigour, often attaining 6 ft. in length. A prolific bearer, producing medium-sized fruit. Fine-grained, with small seeds, suitable for jam making.

Semper Fidelis.—Producing strong canes, sometimes 10 ft. in length. Late in fruiting, prolific bearer, fruit acid, firm, medium to large in size, with very small seeds. This variety is the most favoured of all for jam. It is of no use for table fruit.

The cost of picking is ¾*d.* to ½*d.* per pound, according to district. Near to a good centre of population a good deal of the best fruit can be disposed of in punnets on stalk for table, and this will do a good deal to lift the average. Where the only outlet is to the jam maker, the fruit is "slipped" and sent in tubs.

Of late years the price has come tumbling down, owing to overproduction. Before the fever for Raspberry growing at Blairgowrie became epidemic, the price was £45 per ton, and the crop there 4 tons to the acre. Now there are upwards of 2000 ac. planted round the town the price has got down to £10 a ton, and the crop to 2 tons to the acre.

From 2 to 3 tons may be taken as the average crop, and £18 to £20 per ton—the most favourable prices that can be expected. [W. G. L.]

§ 2. RASPBERRY PESTS

The Raspberry Beetle (*Byturus tomentosus*).—A small beetle, from $\frac{1}{6}$ to $\frac{1}{7}$ in. long, of a pitchy-brown colour, clothed with golden-brown pubescence, which is found flying about as soon as the Raspberry blossom buds show. The beetles then eat the buds, cutting some off; as the flowers open they get into them, and on from that period they lay their ova in the blossoms. The beetles also eat the various parts of the blossoms and ruin them.

On dull days the beetles shelter in the opened and just-opening blossoms, and are difficult to move, but on warm days they fly about and are active. They also feed and lay their eggs in Loganberry and Brambles, and do much harm to the former fruit.

The larva—the so-called Raspberry Maggot—lives in the core or receptacle of the berries, where it forms dark tunnels, and later escapes from the fruit, and, if mature, either falls to the ground or gets into any crevice in the canes or stakes. The maggot is dull yellowish or grey, with brown markings in the middle of all the segments, six jointed legs in front, and the anal segment with a more or less pronounced rudimentary leg and two pointed curved spines; length, $\frac{1}{3}$ in.

Prevention.—All canes cut back should be burnt. Land around the stools may be treated in early spring, before the canes burst into full bud, with vaporite or soot and lime. Jarring, or shaking of the beetles by women, is one certain means of preventing the enormous damage the larvæ may do.

The Raspberry, or Clay-coloured, Weevil (*Otiorhynchus picipes*).—This weevil also attacks other fruit, Hops, and pot plants. The beetles gnaw the buds, shoots, and leaves; and their footless, white larvæ feed on the roots of bush fruit, Strawberries, Ferns, Hops, &c. The weevil is about $\frac{1}{3}$ in. long, pitchy in colour, but covered with light-brown and ashy pubescence, which gives the elytra a tessellated appearance. The snout is short for a weevil. There are no wings. They appear in May and go on through the summer. The Otiorhynchus weevils hide away during the day under clods of earth, boards, stones, &c., and come out to feed at night. The larvæ live over the winter in the soil, and when mature reach $\frac{1}{3}$ in. in length. They pupate in the soil and hatch in early March.

The beetles may be trapped by placing pieces of sacking about on the ground. They collect under this, and may be destroyed in daytime.

The Raspberry Moth (*Lampronia rubiella*).—The caterpillars of this moth sometimes do much harm in Raspberry plantations by destroying the buds and tunnelling up the shoots. The moth is ¼ in. long, with wing expanse of ½ in.; front wings brown. The front wings have yellow spots, of which two on the inner border are the largest; on the outer border are three smaller spots and some still smaller ones at the base, and at the apical border a row of four small yellow specks; hind wings uniform brown; head yellow. The moth occurs from the end of May to June and lays her eggs in the blossoms, and in five to seven days the small larvæ escape and tunnel into the cores of the berries. Here they remain a short time, and then leave the fruitlets and spin small flat cocoons of dull-grey silk, about $\frac{1}{10}$ to $\frac{1}{12}$ in. in diameter. These cocoons are found either under the soil, the rind of the canes, or in the stake crevices. Here the little larvæ remain all the winter. In spring they crawl out and enter the buds and destroy them. Later, they tunnel up the shoots, which flag and die. The larvæ in the buds and shoots are at first pink, then red, and, when mature, reach ¼ in. long. The larvæ pupate where they have fed, the pupal stage lasting from nineteen to twenty-eight days.

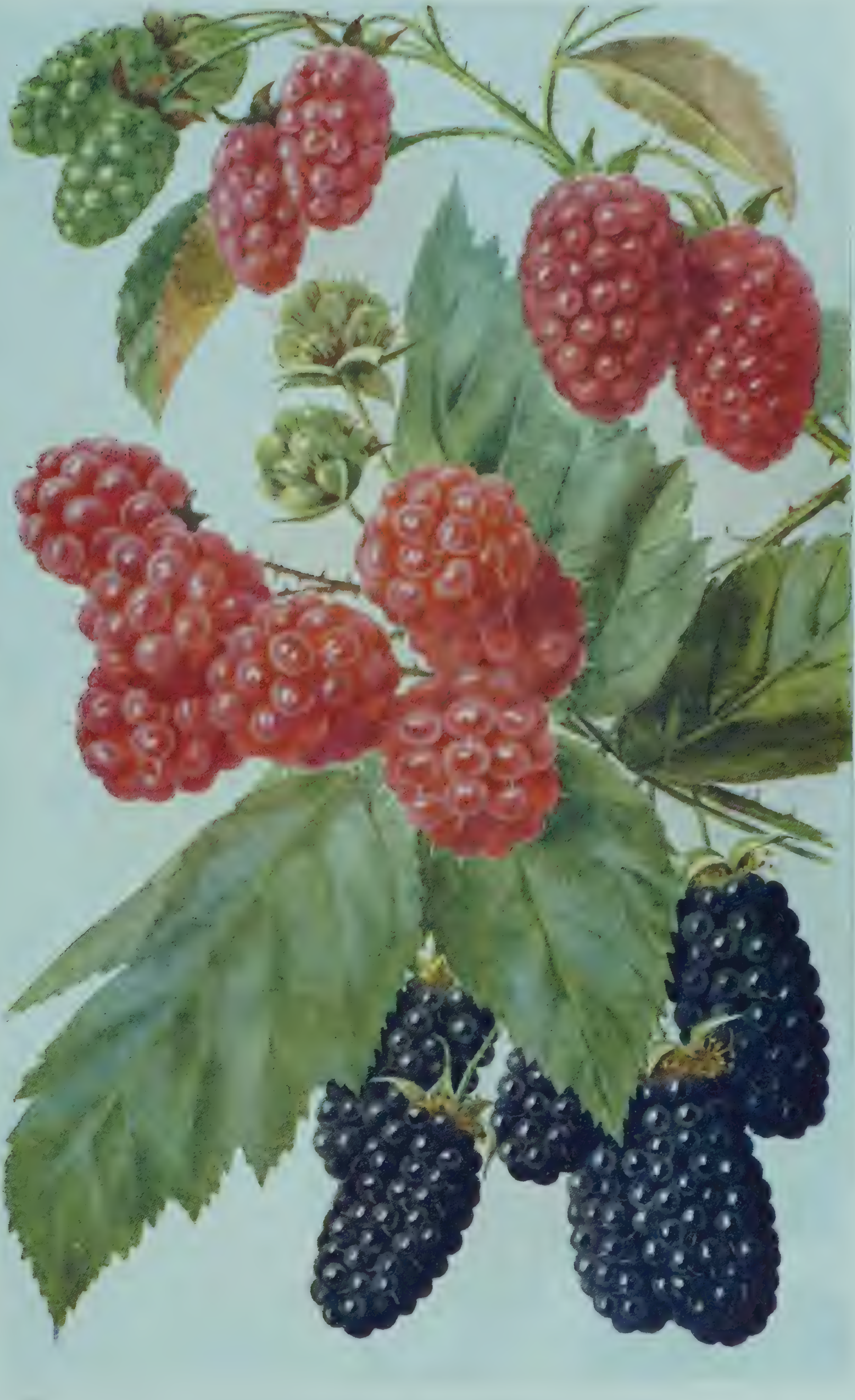
Prevention.—Destruction in winter of all old canes and stakes and refuse on the soil. Smear the lower part of the canes in early March with soft soap to catch the ascending larvæ, and repeat this again in two weeks' time.

Other Raspberry Pests.—The Garden Swift Moth (*Hepialus lupulinus*), the Dot Moth (*Mamestra persicariæ*), the Black Anthonomus (*Anthonomus rubi*), Rose Chafer (*Cetonia aurata*), Cock Chafer (*Melolontha vulgaris*), Summer Chafer (*Rhizotrogus solstitialis*), Raspberry Emphytus (*Emphytus cinctus*), Cane Gall Fly (*Lasioptera rubi*), Raspberry Aphides (*Siphonophora rubi* and *S. chelidonii*). [F. V. T.]

Crown Gall appears to be somewhat prevalent, and accounts for the wilting of the foliage for no apparent reason. The galls are often produced on the branches of the root. Described under "Loganberry".

§ 3. OTHER "BERRY" FRUITS

Loganberry.—This hybrid between the Red Raspberry and the Blackberry (named after the American Judge Logan) is now well known, but it cannot be said that it has yet "caught on" with the market-garden community to any great extent. As it grows vigorously in almost any soil, and requires but very little attention, there is no reason why it should not be planted in waste corners of the garden where there is at least abundance of sunshine, for it loves the light. The white starry flowers appear at the end of April and early in May, from eight to twelve in a loose panicle on the shoots that spring from last season's growths—these often attaining a length of 12–16 ft. The plants resemble the Black-



LOGANBERRIES AND KINDRED FRUITS

1. The Loganberry. 2. The Laxton Berry. 3. The Low Berry.

berry more than the Raspberry in appearance of flowers and foliage, but the fruits are much larger than those of either and quite distinct in flavour. Although perhaps a little too acidulous for dessert, there is no doubt as to their value for preserves, and they ought to find a ready sale among jam makers. Under good conditions one plant will produce from 5 to 10 lb. of fruit. (See Coloured Plate.)

Cultural treatment consists in giving a dressing of well-rotted manure in the winter when the soil is being forked up lightly, and in cutting out all the dead canes that fruited of the last year's growth. The best of the young shoots should be retained and tied to stakes or fences, and the tops should be shortened back a few inches, but not severely, as in the case of Raspberries.

Blackberry.—Perhaps because this is a wild British fruit it does not find favour with growers, and yet its fruits, picked from the hedges, find a ready sale in the autumn. One might do worse than grow some plants in the same way as the Loganberry, where the fruits cannot be purloined by every passer-by.

Besides the Loganberry and the Blackberry, other "berries" have appeared recently, among them being the "Low Berry", the "Laxton Berry", &c. (See Coloured Plate.) The American Blackberry (*Rubus laciniatus*), the Japanese Wineberry (*R. phœnicolasius*), and American varieties of the common Blackberry known as Lawtons, Kittatiny, Mammoth, Wilson, Junior, &c., have been in cultivation for some years, and although they bear masses of excellent fruit they are practically confined to private gardens. (See Coloured Plate.)

The only disease worth noting in connection with the Loganberry and allied fruits is "Crown Gall". This disease has probably been present in this country for a long time, but has not been recognized with certainty until recently. The disease forms galls or tumours at the collar, or sometimes on branches of the root, and as they are usually underground they are often passed over. The galls vary in size from a marble to that of a football, and are coarsely warted or wrinkled. Several specimens on the base of the stem of the Loganberry have been observed in this country, as also have specimens on Plum, Chrysanthemum, Rose, and Raspberry. In the United States, Crown Gall is considered as one of the most serious diseases with which the fruit grower has to contend. It is most destructive in the nursery, where it spreads along the rows, killing the young trees wholesale. Apples, Plums, Cherries, Quinces, and in fact practically all fruit trees, and several forest trees, are attacked. When older trees are infected they may live for many years, but the produce is smaller in quantity and inferior in quality to that of healthy trees.

When the galls are not large they should be removed, and the wound covered with a paste composed of 1 oz. each of sulphate of copper (bluestone) and of sulphate of iron, and 2 oz. of quicklime.

Quicklime should be worked into the soil in orchards, &c., where Crown Gall is present. [G. M.]

The chief pests attacking Loganberries and allied fruits are the Raspberry Beetle (*Byturus tomentosus*), the Clay-coloured Weevil (*Otiorhynchus picipes*), the Daddy-long-legs (*Tipula oleracea*), the Heart-and-Dart Moth (*Agrotis exclamationis*). (See Vol. I, p. 166 *et seq.*)

Mulberry (*Morus nigra*).—This can only be regarded as an ornamental tree, easily grown on lawns in the southern parts, and against walls in less-favoured localities. Its fruits are delicious when ripe, but they give too much trouble for the market grower to worry about. Any fruits that find their way to market are chiefly from private sources.

STRAWBERRIES

§ 1. CULTIVATION

The Strawberry.—The Strawberry (*Fragaria*) is a very important market-garden crop in England, where about 21,000 ac. are devoted to its culture. The most important centres appear to be Kent, 6733 ac.; Hampshire, 2406 ac.; Cambridge, 2336 ac.; Norfolk, 1798 ac.; Worcester, 1102 ac.; Essex, 567 ac.; Cornwall, 542 ac.; Lincoln, 484 ac.; Middlesex, 432 ac.; Hereford, 421 ac.; Cheshire, 371 ac.; and Yorkshire, 300 ac.

In Scotland about 3000 ac. are down to Strawberries, 1234 ac. being in Lanarkshire, 500 ac. in Perthshire, and 218 ac. in Aberdeenshire. Only about 1000 ac. are given for Strawberries in Ireland, the great bulk being grown in the counties of Armagh and Dublin. Wales grows a little over 500 ac., of which Denbighshire absorbs about 480 ac.

It would be easy to deduce from these figures, and indeed from those given for other crops, that England, being the centre of government in the British Islands, naturally attracts the lion's share of the fruit trade as well as the population. One is a natural corollary of the other, and it is evident that if the population were better distributed over the kingdom trade would develop to support it.

Strawberries like a good and fairly heavy loam that has been deeply cultivated and well manured. The deeper the cultivation in advance of planting the better, as the soil is thus rendered warmer and earlier, and there is but little trouble afterwards with weeds. In many places Strawberries are looked upon as a catch crop between young fruit trees, until the latter are large enough to require all the space to themselves, and one, two, or three rows are planted between, according to circumstances. When grown in large breadths, from 11,000 to 16,000 runners are planted to an acre, the average cost for young plants being about 10*s.* per 1000, although they are often advertised at half this price. At 2 ft. apart every way an acre will hold 11,000 plants, and 20,000 at 2 ft. by 1 ft.. The latter number, however, is too great, except perhaps in the case of varieties like "Stirling Castle" and the "Old Scarlet", that are grown chiefly for jam. Amongst the best dessert kinds are "Bedford Champion", a large, highly coloured mid-season variety; "Royal Sovereign", for early work; "Sir Joseph Paxton", mid-season; "Noble", early; and "Givon's Late Prolific", a strong-growing dark-crimson late variety. Older varieties still grown in places are "Keen's Seedling", raised at Isleworth in 1823; "President"; and "Sir Charles Napier". When well grown, a single plant will carry as many as 100 fruits, about 40 of which will weigh 1 lb., thus giving about 2½ lb. per plant. Reckoning 11,000 plants to the acre, this gives over 12 tons of fruit to the acre. It may be taken for granted, however, that half this quantity (6 tons) is rarely obtained, and 3 tons would be considered a good average open-air crop, and many of the fruits would be far from first grade.

Many modern growers send the fruit to market in chip baskets holding from 4 to 6 lb., covering them over with stout paper on which their name and address (or that of their commission agent) is printed. A 4-lb. basket measures about 11 in. long, 6 in. wide across the top, and about 3½ in. deep, and weighs about 4 oz., the cost being from 80*s*. to 90*s*. per 1000. Baskets holding larger quantities are also used, but only when the prices have tumbled down. For early supplies small chip punnets, or baskets holding 1 lb., are used, and contain only selected "berries" that fetch good prices, and thus raise the average for the entire crop.

One of the most expensive items in connection with Strawberry cultivation is "strawing" between the plants. Some growers use long littery stable manure at the rate of 30 to 40 tons to the acre. It is put on the ground early in spring, so that it may be washed clean by the rains by the time the fruit is to rest upon it. In this way two birds are killed with one stone—the ground is well manured and the fruits are kept clean from mud splashes. Others prefer to use clean oat or barley straw at the rate of 15 to 30 cwt. per acre, and this will cost from £2 to £3. Of course a certain amount of this must be credited as manure, perhaps the greater portion.

As to manuring, there is nothing to beat a good dressing of stable manure. From 12 to 15 tons would be a fair quantity for retentive soil, while twice as much would be necessary for lighter land. If chemical manures are used at all they should be used sparingly, and one of the best for Strawberries is basic slag applied at the rate of 5 or 6 cwt. per acre about the middle of January. The use of nitrate of soda is apt to make the fruits too watery and thus less fit for transport, besides which it would be quite unnecessary if stable manure had been dug in previously.

The ash analysis of the Strawberry given in Vol. I, p. 109, will serve to guide the grower as to what foods are taken out of the soil. The ash represents only 3·34 per cent of the entire weight of the plant, thus leaving 96·66 per cent to water and carbonic acid gas from the atmosphere (see Vol. I, pp. 44, 108). The fruit contains 90 per cent of water and the plant 62·3 per cent. The following analysis of the Strawberry by M. J. Isidore Pierre, taken from *Success with Small Fruits*, by E. P. Roe, may be of interest:—

Composition of Water-free Strawberry Crop (except roots) in pounds per acre

	Plants.	Fruit.	Total.
	lb.	lb.	lb.
Organic matter, exclusive of nitrogen ...	4268·4	1053·5	5321·9
Nitrogen	88·5	16·0	104·5
Silica, iron, and manganese oxides ...	43·3	5·3	48·6
Phosphoric acid	35·3	5·4	40·7
Lime	102·7	7·9	110·6
Magnesia	16·1	·7	16·8
Potash	89·1	19·7	108·8
Soda...	6·4	·9	7·3
Other matters	120·9	8·8	129·7
Total dry substance	4770·7	1118·2	5888·9

The approximate expenses of, and receipts from, an acre of Strawberries grown in the open air may be tabulated thus:—

Expenses.	£	s.	d.	Receipts.	£	s.	d.
Rent, rates, taxes ...	3	0	0	3 tons at £20 per ton ...	60	0	0
Manure	10	0	0				
Picking, say, 3 tons ...	10	0	0				
Packing and marketing ...	12	0	0				
Cultivation	3	0	0				
Strawing	3	0	0				
Baskets	5	0	0				
	46	0	0				
Balance profit ...	14	0	0				
	60	0	0		60	0	0

Forcing.—To succeed in forcing Strawberries for profit, it is essential in the first place to secure good strong plants. It is waste of time and money to force weak plants, and the results from such can never be satisfactory from a financial point of view.

To secure vigorous plants, the best way is to put out in early autumn a certain number of young plants for the production of runners early in the following year. Plants that are allowed to carry a crop of fruit first, produce runners not only later but also less vigorous. The bed should be placed as near the water supply as possible, to save work in watering.

As soon as the flower trusses appear in spring they should be pinched out. All the energy of the plant will thus be directed to the production of runners, of which there will be a good supply, as a rule, about the end of June.

For layering the runners, small 60's (2½-in. pots) are the most suitable.

No crocks need be used in these for drainage purposes, and any ordinary good soil will do for filling the pots, pressing it down firmly, but not making it hard.

A single layer should be placed in each pot, and may be kept from shifting by placing a stone on it, or by pegging it down with a cheap hairpin (100 for 1*d.*) The method adopted by the writer is to pass a piece of raffia about 3 in. long round the runner stem just behind the crown, give it a twist, and press the ends into the soil with a blunt dibber. It is quickly done, and long before the raffia decays the runner will be well rooted and fit to sever from the parent plant. Only one layer should be made from each runner; those growing beyond should be pinched off unless stock is very short, when two layers from each runner may be taken.

The runners should be kept well supplied with water, and at the end of a month or so they will be well rooted and ready for moving into fruiting pots. These should be 32's (6 in.), as smaller ones do not give satisfactory returns, and entail more labour in watering. The pots should be clean and well drained, with a layer of crocks over a stopper in the bottom. The soil should consist of 3 parts of good rather light loam, and 1 part of well-rotted manure, such as may be obtained from an old mushroom bed. Add a sprinkling of soot, and mix the whole thoroughly a few days before using. The compost should be protected from rain, as it is very injurious to pot the plants into wet, sticky soil.

In potting, the crown of the plant should be kept well up, and not buried lower than the surface, and the soil should be made very firm round the roots with a good ramming stick, leaving, of course, sufficient space on top for watering.

After potting, the plants should stand on a good hard bottom in an open sunny situation, and should not be crowded close together. Attention must be given to suppressing weeds and runners, thus allowing each plant to concentrate its energies in making good crowns.

Water must be given in abundance, and when the pots are becoming full of roots weak manure water may be given with great advantage. The drainings from the stable, well diluted, are as good as, if not better than, any artificial manures, and the cost is much less.

On the evenings of hot days, a good syringing from the hose will be found very beneficial, and will greatly help to keep down Red Spider, which is the worst enemy of the Strawberry.

Before severe frost sets in, the pots should be plunged in ashes, or some litter should be put between them, to prevent them from being cracked by frost. It used to be thought necessary to put the plants in cold frames, or make them into stacks with ashes between the pots; but this is quite unnecessary labour.

Unless for a special object very early forcing is not very profitable. Although prices may be high there is only a limited demand for the fruit, and the plants will not bear such heavy crops as they would later on. The first batch of plants should be brought into the houses early in January, and if a continuous supply of ripe fruit is desired, batches should be brought in every three weeks. They are best accommodated in a house by themselves. In most places, however, shelves in early Peach houses and vineries are utilized for the purpose of growing Strawberries.

A temperature of 50° F. is ample to start with, and as the days lengthen from 5 to 10 degrees extra may be given, but a high night temperature from fire heat is very harmful.

The plants should be syringed when the other occupants of the house require it; but in naturally damp houses, without stone or brick floors, syringing is not necessary.

When the plants are first brought in, allow them to stand for a few days to dry; also see that the drainage is good, and make each plant firm in its pot. When the bloom trusses appear, spread a layer of well-rotted manure on the shelf and stand the pots on it, pointing all the trusses of flower to come one way towards the light.

The plants will soon root into the manure through the drainage holes, and the flower trusses will be thrown well up from the pots.

At this stage a pinch of some good fertilizer to each plant will be found very beneficial. When the plants are in flower the atmosphere should be kept in a buoyant condition by opening the ventilators a little, and the flowers should be fertilized with a camel-hair pencil or rabbit's tail, doing this when the pollen is dry, generally about midday. When a sufficient number of flowers have set to ensure a good crop, the others should be cut off at once. This will concentrate the energies of the plant into swelling the fruits.

Before the fruit gets too heavy to bend the stems, the trusses should be kept up by running a string on a few sticks along the front of the row of plants. This will be found much better than tying each plant up separately. Where, however, several rows are grown on a stage, it is better to tie each plant up.

The soil must not be allowed to get dry, and the plants should be well fed at alternate waterings with some good stimulant, and all syringing and damping should cease as soon as the fruit shows signs of colouring.

Gathering is best done when the fruit is quite dry, and if it has to be sent by rail, pack in shallow boxes, one layer deep only. The fruit should not be allowed to get too ripe, and should be graded into best and seconds, which will be found better than mixing large and small fruits together.

If the fruit is sold locally, it may be packed in ½-lb. punnets with a lining of fresh leaves to make the "berries" look attractive.

A good paying crop of strawberries can often be secured from plants without any fire heat whatever. The plants should be put into the houses or in pits at the beginning of March, and allowed to grow on naturally. Ripe fruit will be available just before the outdoor crop comes in, and if the weather is hot prices sometimes run very high.

Instead of putting the plants into their fruiting pots in August, they may be planted out on a piece of open ground in rows about 2 ft. apart. They must be watered if necessary, and all weeds and runners kept under. Under these conditions the plants will make good crowns, and they should be lifted and potted in March, or they may be planted direct into pits, within 12 in. of the glass, to allow of the fruit trusses being tied up and exposed to the sun. A stake on each side of the plant, and a string round, will be found the best and quickest method of supporting the fruit. On a hot day in May water will be necessary twice a day, in the morning and afternoon, and any neglect of supplies will soon show.

Should the plants, when under cover, be attacked by green fly a fumigation with tobacco will be found the best remedy, taking care not to do it when the plants are in full flower, or some of the organs may be damaged, and the flowers fail to set well. Red Spider will sometimes attack the plants, especially if they are allowed to suffer from lack of water and feeding.

Should mildew appear on the plants, sulphuring the pipes when hot will be found the best remedy; but this cannot be applied if the Strawberries are growing with plants that are tender and liable to injury. In this case dissolve ½ oz. of sulphide of potassium (liver of sulphur) in 1 gall. of water and syringe the plants with it, using a very fine spray and wetting every part. If thoroughly done, one application is generally sufficient, and as the price of sulphide is only about 1*s*. per pound the cost of this remedy is very small.

Years ago, Keen's Seedling, La Grosse Sucrée, Viscomtess Hericart de Thury, President, Sir Chas. Napier, and Sir Joseph Paxton used to be the varieties grown for forcing, but they are now all superseded by Laxton's Royal Sovereign. It is safe to say that practically no other variety is now grown under glass for profit. It is found to be a good "doer" in every way, and each plant will produce twice as much fruit as the old Keen's Seedling used to.

La Grosse Sucrée is a good variety for very early work, especially in the vicinity of towns, as it sets well under adverse conditions; but the fruit is not so large, or of such a bright attractive colour, as Royal Sovereign; and it is the same with strawberries as with apples—the colour helps to sell them.

President is a good Strawberry for cropping and flavour, but will not stand very early forcing; and Paxton was always subject to attacks of mildew. The average weight of fruit from forced plants should be about ½ lb. each, and individual berries often weigh 2 oz. under the best conditions.

Very early fruit is sometimes sold at a very high figure on special occasions, but the days of high prices are gone. There is too much selection for consumers now—when peaches, plums, pears, apples, and grapes in almost endless variety can be procured all the year round—to induce them to give fabulous prices for strawberries. Still, however, with an average price of about 3*s*. per pound there is some profit to the grower, as a heavier weight is produced per plant; and once stock is obtained there is no great outlay except for labour, as the pots will last several years, and the plants are often grown on shelves where nothing else will succeed. For several months, when the plants are once plunged outside, no attention is required, and a market can generally be found if the fruit is first class. There is always room for the best on top, and that is where the "Sovereigns" are to be found. [A. J. B.]

§ 2. STRAWBERRY PESTS AND DISEASES

Strawberry Ground Beetles (*Harpalus ruficornis*, &c.).—At least four kinds of ground beetles, often called Bat Beetles, attack ripening and ripe strawberries.

The commonest is the Red-legged Strawberry Beetle (*Harpalus ruficornis*), which is ½ in. long, black, with red antennæ and legs, the wing cases with faint lines upon them and covered with fine golden-grey pubescence; beneath are a pair of fully developed wings.

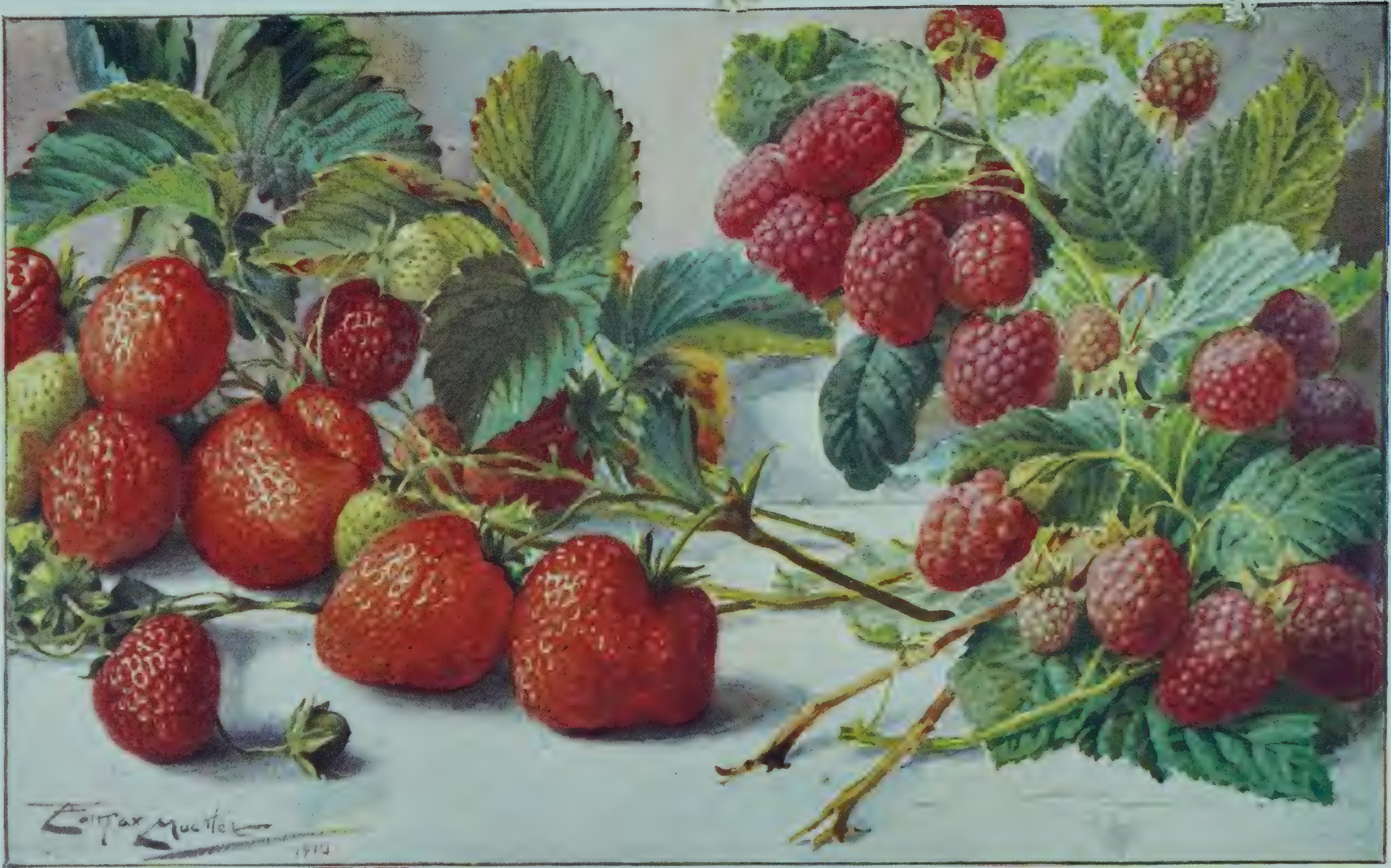
Another, *Pterostichus vulgaris*, is black, with black legs, and has no wings, and is ⅔ in. long.

These beetles have all very similar habits. They are nocturnal and crawl or run about on the ground, but the Red-legged Harpalus may fly. During daylight they hide away in crevices in the ground and under stones, &c. They frequently form circular openings to the surface like earthworms. The beetles occur in May, June, and July. They lay their ova in the soil, and the active larvæ feed upon slugs, insects, earthworms, &c., in and upon it. The larvæ have six long legs, prominent head with large sickle-shaped jaws, and the back of their bodies protected by hardened plates, and on the last segment are two pointed, horn-like processes, and below a single extensile fleshy kind of proleg. The beetles eat the skin of the green fruit, leaving many of the seeds; but when the fruit is ripening they feed on the seeds, and countless numbers may be found on the ground in the beds that are invaded by these beetles. Many Carabidæ are purely carnivorous.

PREVENTION.—The beetles are easily trapped by sinking jam pots or pudding basins in the soil here and there, and placing in them pieces of meat and sugar water. The beetles are attracted to these baits, fall in, and are thus caught.

Moles and Hedgehogs feed upon these beetles. The latter do much good in Strawberry beds in this respect.

The Garden Swift Moth (*Hepialus lupulinus*).—The roots of Strawberries are attacked by the white caterpillars of this moth, which appears in May, June, and July, and is seen at dusk flying with a curious pendulum-like movement over plants and grass. In size it varies from 1 to 1¼ in. in wing expanse. The fore wings are pale fulvous brown, with a pale almost white streak running from the base to the inner margin, and this is continued from the inner margin to near the apex; the hind wings are



44.

STRAWBERRY, "Royal Sovereign". RASPBERRY, "Superlative"

(Two-thirds natural size)

brown. The females drop their ova in flight, and the larvæ hatch in nine days, and enter the soil, where they feed all the winter on the roots of all kinds of plants. They are very active, and reach 1½ in. in length. They pupate in the soil in May.

TREATMENT.—Treatment consists of working into the infected land soot and lime, or vaporite, which I have always found kills them, whilst the soot and lime is uncertain in action.

Strawberry Eelworms (Anguillulidæ).—1. Cauliflower Disease (*Aphelenchus fragariæ*). This small worm is only 0·75 to 0·80 mm. long in the female, smaller in the male, yet in numbers it is capable of producing a serious disease in Strawberries known as Cauliflower Disease, owing to the swollen stems and crowded buds producing a growth similar to that vegetable. The minute white Eelworms are found in the buds and other parts of the plants, where they breed. The worms can also live in the soil for some time. All diseased plants should be lifted at once and burnt, and the holes filled in with hot lime.

2. The Root Eelworm (*Tylenchus devastatrix*) also does harm to Strawberries. The attacked plants rot and decay away below and at ground level. The leaves become crinkled, especially at the edges. This is the same parasite that causes Tulip Root in Oats, and occurs in Onions, Clover, and Hyacinths, in Hops and decaying Cabbage stumps. The worms live and breed in the plants and also exist in the soil. The female is $\frac{1}{20}$ in. long. Lime and sulphate of potash have most effect on Eelworm and should be used where the plants are attacked. Sulphate of potash, however, often has a bad effect on the plants.

Other Pests.—Other pests attacking the Strawberry are the Surface Larvæ, the caterpillars of the Heart-and-Dart Moth (*Agrotis exclamationis*), and those of the Yellow Underwing (*Triphæna pronuba*). These may also be killed with vaporite in winter.

Four weevils attack the Strawberry, the Strawberry Otiorhynchus (*Otiorhynchus sulcatus*), the Black Anthonomus (*Anthonomus rubi*), the Small Fruit Weevil (*Exomias araneiformis*), and the Minute Rhynchites (*Rhynchites minutus*). But none of these are of general importance.

An Aphis (*Siphonophora fragariella*) now and then attacks Strawberries, and may be treated by spraying with soft soap and quassia; and a small moth, the Strawberry-leaf Button Moth (*Peronea comariana*), sometimes does harm by attacking the leafage in its caterpillar stage. Slugs (Limacidæ) and a snail (*Helix rufescens*) also do some damage. [F. V. T.]

Strawberry-leaf Spot (*Sphærella fragariæ*).—This disease is prevalent wherever the Strawberry is cultivated, and is always in evidence, although it is only now and again that it assumes the proportions of an epidemic. As a rule it appears rather late in the season, after the crop has been picked, where its presence is usually ignored. This is unfortunate, as the mass of spores produced are quite likely to set up the disease quite early in the following season. The leaves only are attacked, and the symptoms are unmistakable. Small reddish patches first appear, almost equally well marked on both surfaces of the leaf. These patches continue to increase in size, usually retaining a more or less circular outline, and often run into each other. By degrees the centre of each patch becomes greyish, or often almost white, and is bounded by a reddish border, which is often quite bright in colour during the autumn. The pale central portion soon becomes covered with minute tufts of the summer fruit of the fungus, once known as *Ramularia tulasnei* and supposed to be the only form of fungus connected with the disease. The dispersal of the summer spores causes the disease to spread rapidly during dull, damp weather. Later in the season the winter form of fruit appears on the pale patches. These dead patches do not fall away from the leaf, but persist until the leaf actually decays, when the spores are liberated.

When the disease appears early in the season, the crop of fruit is much reduced both in quantity and in quality, The plants are also weakened for the following season.

The most certain way of dealing with Strawberry beds that have been diseased is to mow off the leaves soon after the fruit has been picked, and, when the mown leaves are fairly dry, to cover the whole bed with a sprinkling of straw, litter, or other convenient material that will burn well, and set it on fire. By this method not only are all diseased, spore-carrying leaves destroyed, but also dead fragments of leaves and spores lying on the ground. The destruction of many injurious insects is also included.

During the spring following the burning, the plants should be sprayed with sulphide of potassium, commencing when the leaves are quite young. Spraying should be continued at intervals until the blossom begins to open. If this procedure is followed the disease can be eradicated.

Strawberry Mildew (*Sphærotheca humuli*).—This pest has long been known as an enemy of Strawberries, both cultivated and wild plants suffering equally. This same fungus is also the cause of the still more serious "Hop Mildew", and is also more or less common on about twenty kinds of British wild plants, hence the opportunities for cultivated plants becoming infected are ample. Fortunately, in the case of Strawberries, only the leaves, as a rule, are attacked, and that usually somewhat late in the season. When the leaves are attacked the edge bends upwards, exposing a considerable amount of the under surface of the leaf, which, on careful examination, is seen to be more or less covered with a very delicate, whitish mildew, which is powdery here and there, due to the accumulation of the summer spores of the fungus. When the fungus attacks the foliage early in the season, before the flowers expand, the mildew passes on to the fruit, which usually becomes entirely covered with a white mildew. The fungus does not usually retard the growth or ripening of the fruit, but it renders it absolutely useless—being devoid of all sweetness, and having an insipid and watery taste. It is not unusual to meet with fruit on sale that has been rinsed in water to get rid of the mildew; but it presents a dull, waterlogged appearance, and, as stated above, is worthless for eating or jam making.

Where the disease has previously existed the leaves should be mowed and burned, as described under "Strawberry-leaf Spot". Early the following spring, when the leaves are expanding, spraying with sulphide of potassium should be commenced, and continued at intervals, if a trace of mildew is observed, until the blossom is ready to expand. The under surface of the leaf is the part attacked by the mildew, hence the nozzle of the sprayer should be of such a pattern as will allow of its being placed close to the ground, under the leaves. [G. M.]

SECTION XXIV

Figs

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§ 1. CULTIVATION

The Fig (*Ficus Carica*), although a native of the Mediterranean region and south-western Asia, is fairly hardy in most parts of England and Ireland, and quite hardy in the mildest parts. As a market or commercial crop it does not figure largely. It is, however, grown in almost every large garden of repute, either on walls with a southern aspect or in pots in greenhouses. It has large deeply lobed leaves, and is remarkable for its thick milky juice and the pear-shaped "fruits" which are borne on the young branches.

The fruits are interesting from a structural point of view. If turned inside out they would resemble the Strawberry "fruit" somewhat in character. What is eaten as the fruit is really the fleshy receptacle on the inner surface of which the flowers are borne. In one form of the Fig, known as "Ficus", female flowers only are borne; in another form, called "Caprificus", male flowers are borne near the opening, and what are known as "gall" flowers lower down. The gall flowers do not produce seeds, but are used by a small wasp (*Blastophaga grossorum*) in which to deposit its eggs. The larvæ from these occupy the ovary and form a gall. In crawling in and out of the flowers these little wasps carry the pollen from the male to the female flowers, and thus ensure fertilization. The illustration (fig. 377), from Kerner and Oliver's *Natural History of Plants*, shows the fruits, with male and female flowers, and the insects which visit them. The visits of the insects from one kind of flower to the other result in the process known as "caprification". It is thought that this is essential to secure the best fruits. In the British Islands, however, excellent Figs are produced without the caprification process.

Open-air Culture.—Fig trees flourish in warm, sheltered, and sunny spots in any good garden soil that has been deeply dug or trenched and well manured. The best time to plant is about March or April, in mild weather and when the soil is friable and easily worked. Autumn planting is not to be recommended, as the plants are likely to suffer in the event of severe frosts overtaking them. The soil should be made firm about the roots, and to prevent grossness of growth a slight dressing of basic slag

(2 oz. to the square yard) or some lime should be sprinkled over the border early in spring—more particularly if an annual top-dressing of well-rotted manure is given the preceding autumn.

The fruits appear on the young shoots, and those that are first to ripen are already to be seen on the plants in autumn and winter when the leaves have fallen. In the sketch (fig. 378) the large fruits shown at *a* are not likely to pass safely through the winter in the open air; while the smaller ones, shown at *b*, will. Beneath the smaller fruits there is a bud from which a new shoot will develop in spring. As the large fruits that are on the shoots in early winter never have a chance of ripening outside, they should be removed. This will induce the trees to throw out a better supply of fruiting shoots in spring.

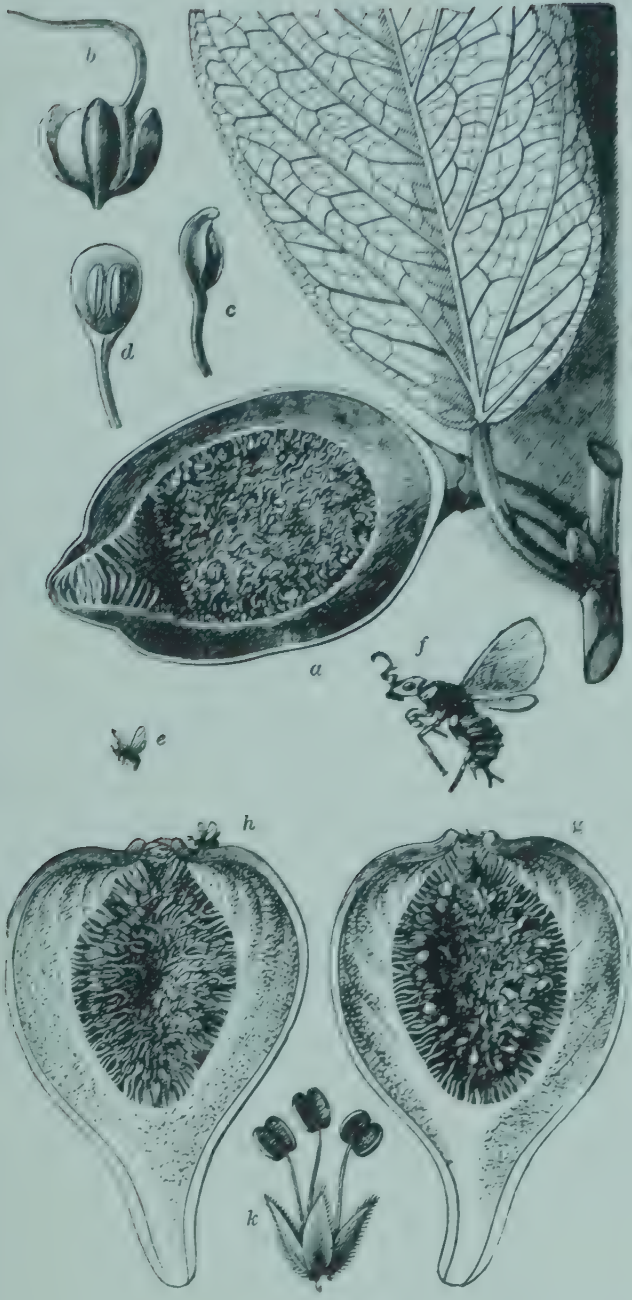


Fig. 377

a, Twig with inflorescence of *Ficus pumila*; the urn-shaped inflorescence (or synconium) cut through longitudinally. *b*, Single female flower from the bottom of the synconium of *Ficus pumila*. *c*, *d*, Stamens of the same plant from the upper part of the synconium. *g*, Synconium of *Ficus Carica* full of gall-flowers produced by *Blastophaga*, cut through longitudinally; near the mouth of the cavity is a Fig-wasp (*Blastophaga grossorum*) which has escaped from one of the galls. *h*, Synconium of *Ficus Carica* full of female flowers, cut through longitudinally; near the mouth of the cavity are two Fig-wasps, one of which has already crept into the cavity, whilst the second is about to do so. *k*, Male flower. *e*, A liberated *Blastophaga grossorum*. *f*, The same magnified *a*, *e*, *g*, *h*, natural size; *b*, *c*, *d*, *k* × 5; *f* × 8.

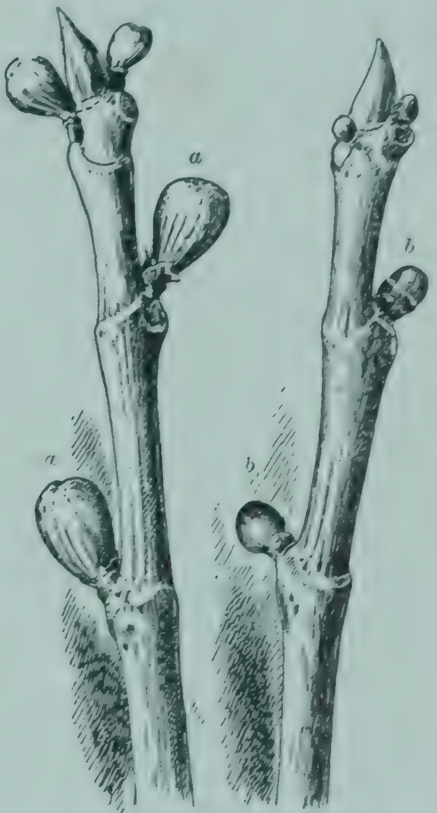


Fig. 378.—Fig-shoots

a, Fruit-buds too large to winter:
b, fruit-buds of right size to winter.

Pruning.—Fig trees require but little pruning, beyond cutting out unnecessary growths. As the young shoots bear the fruit near the extremities, as shown in the drawing, the best of these should be retained, and should on no account be pinched or stopped. Each year the shoots should be spaced out when grown on walls so as to allow the light and air to reach the shoots and leaves, and in the course of time an enormous area will be covered by one plant.

Culture under Glass.—Figs may be grown in pots of various sizes, or may be planted out under glass. If grown in pots a good compost is 3 parts fibrous loam and 1 of well-rotted manure, and old mortar rubble, or a little basic slag. The pots should be well drained, and the soil should be worked in firmly round the roots, the work of potting being done during the resting period. Once growth commences attention must be paid to watering, care being taken to give neither too much nor too little. The temperature of the house may vary from 50° F. by night to 55° or even 60° F. by day, and a few degrees more when growth is in full swing. The plant may be syringed in the mornings and afternoons on all fine days; and the ventilators must be regulated in accordance with outside conditions. Figs in pots may be grown as bushes (fig. 379) or standards (fig. 380).

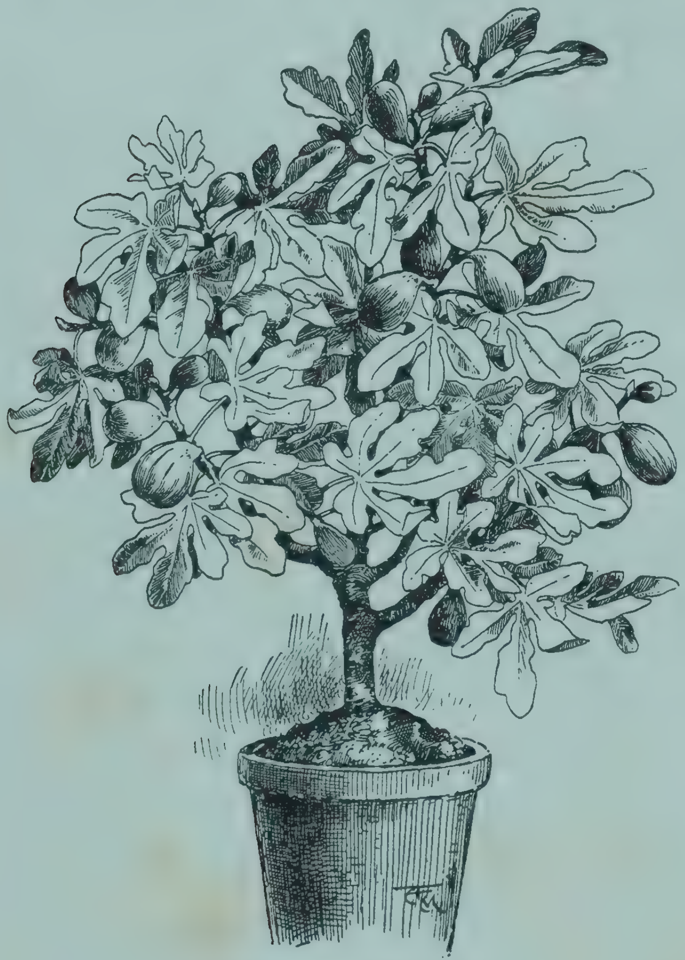


Fig. 379.—Bush Fig in Pot

When planted out under glass it is probably more economical to place Figs against a wall, as they will not occupy so much space. In some gardens in Guernsey and other places where Fig trees have been established for many years, glass houses were simply built over them to secure a couple of crops of fruit each year. The branches spread in all directions from the top of the main stem, and cover a space of from 60 to 100 sq. yd. In Mr. E. H. Ogier's nursery at Duvaux, St. Sampson's, Guernsey, there is a Brown Turkey Fig tree, about sixty years of age, which covers about 180 sq. yd. of ground. The shoots are kept up near the light by means of a framework made of battens nailed together at right angles, and leaving spaces about 4 ft. square. Through these the grower can push his body, and attend to tying, pruning, picking the fruits, &c., without damaging the plants. A large tree such as described will yield 300 to 400 doz. Figs twice, and even three times, a year, the first crop being ready about the middle of April. As these usually sell at 1s. per dozen, the yield may be regarded as excellent. The variety most favoured is "Brown Turkey", but several others are grown and treated in precisely the same way.

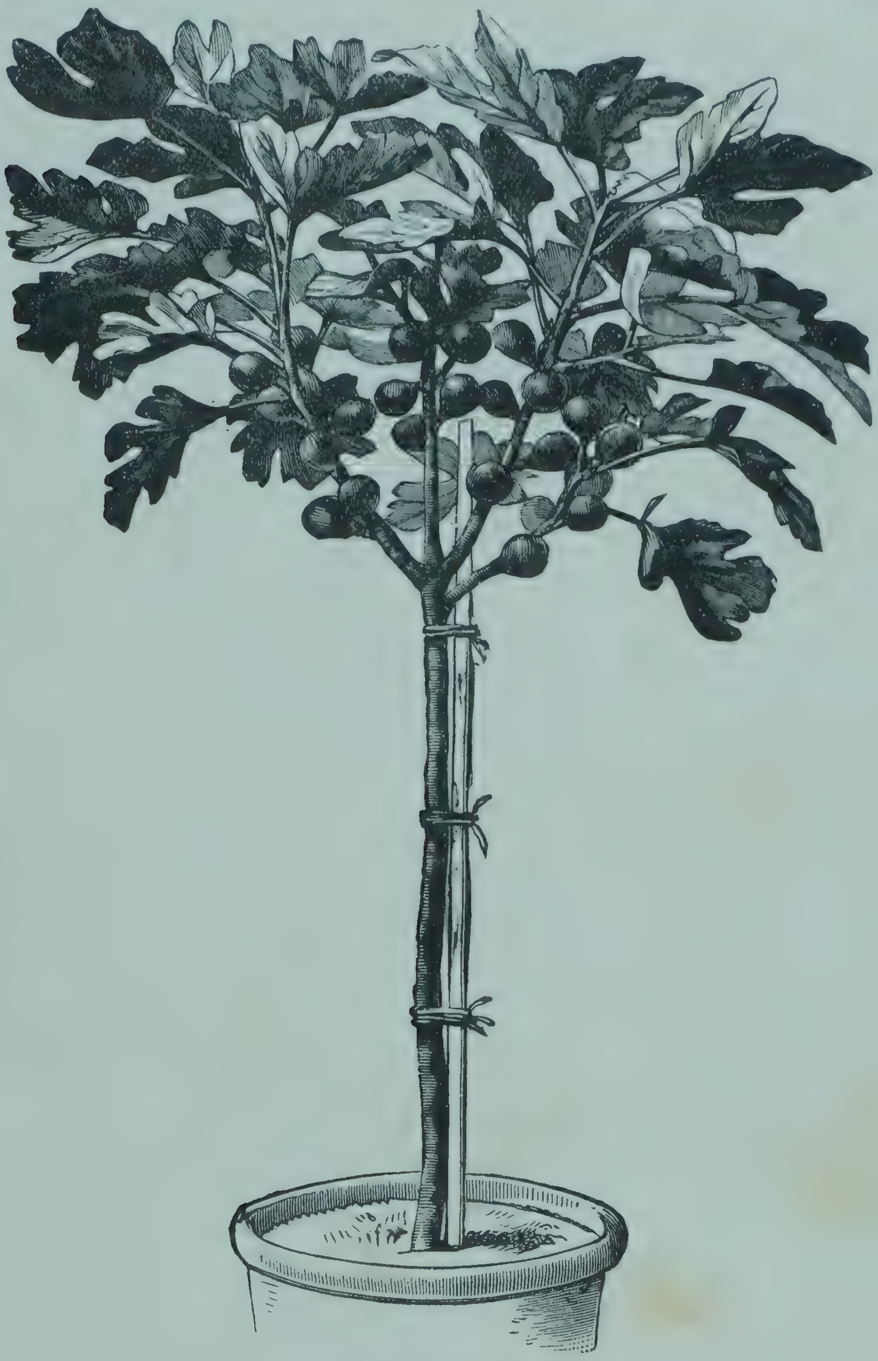


Fig. 380.—Standard Fig in Pot

§ 2. FUNGOID DISEASES AND INSECT PESTS

Fig Canker (*Libertella ulcerata*).—This disease, which appears to be confined to this country, often does an immense amount of harm to plants, whether grown under glass or in the open. Soon after infection the bark becomes dry, and minute radiating cracks appear, which gradually extend in all directions until eventually a large canker-like wound appears, which, in the case of the trunk or a stout branch, may extend for many inches. The fungus continues to live in the cankered patch until all the bark and sapwood are completely eaten away. The wood situated below a wound changes to an ashy-grey colour, a point which at once determines the cause of the injury. When young shoots are attacked they gradually die back from the tip, on account of the food supply being checked by the fungus. The fruit of the fungus appears only on dead portions of the plant, and appears on the surface of the dead bark under the form of numerous minute hair-like bodies, which consist of myriads of the minute spores of the fungus. The parasite can only gain access to the wood through wounds, which may be due to various causes, as pruning, broken twigs, the chafing of branches against each other, or even to the punctures of insects.

Branches, whether large or small, that are ringed by the fungus, should be removed, as it is on such branches, above the wound, that the fruit of the fungus is produced, thus furnishing a source of infection. When a wound is confined to one side of a branch the diseased portion should be cut away, care being taken to remove all the wood that is stained grey, as such wood contains the mycelium of the fungus, which would spread and break out higher up the branch. All cut surfaces should be protected with Stockholm tar; ordinary gas tar should not be used, as it injures the living bark with which it comes in contact. Care must be taken not to cut healthy parts of a plant with a knife that has been used for cutting away diseased portions, until it has been thoroughly cleaned.

Fig Rot (*Botrytis cinerea*).—Figs grown under glass frequently become diseased and rot when about half-ripe. The free end of the fruit presents a waterlogged appearance. This is quickly followed by the appearance of a dense mouse-grey mould, and the entire fruit soon collapses with a wet rot and becomes entirely covered with the mould. When the trees are supplied with an excess of nutrition, the half-ripe "fruit" often emits a small amount of a sweet fluid through the pore or opening at its apex. The spores of the fungus readily germinate in this liquid and attack the fruit itself. In this case the action of the fungus is secondary, its presence being favoured by the overfed condition of the plant. [G. M.]

Four scale insects attack the Fig now and again under glass, but seldom do much harm, and can easily be kept down by hand treatment with paraffin washing. The insects are the Soft Brown Scale (*Lecanium hesperidum*), the Camellia Scale (*Aspidiotus camelliæ*), the Narrow Fig Scale (*Lepidosaphaes ficus*), and the Long Black Scale (*Ischnaspis filiformis*). Thrips, Mealy Bug, and Red Spider may also attack Figs.

[F. V. T.]

SECTION XXV

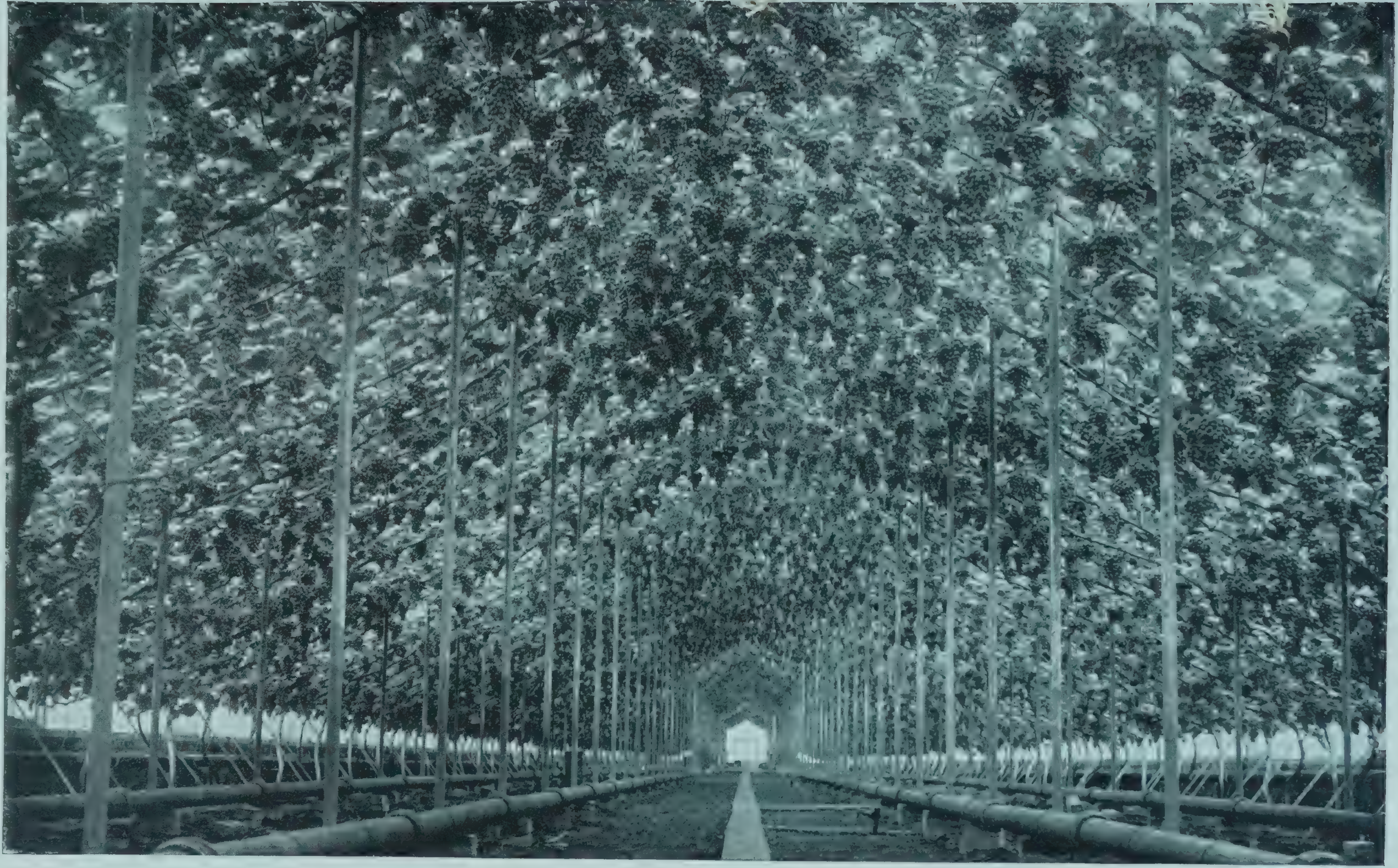
Grapes

§ 1. CULTIVATION

Grape growing as a commercial undertaking has come into existence within the last forty years, and in that time has passed through all stages—from small production and high prices to the enormous output of the present time, with the keenest competition, both home and foreign, a trade can well experience. In the early days of the industry, grapes could be made to pay grown on any soil and, one might almost say, anyhow. In places where the natural soil did not suit the Vine, it paid to make the most elaborate preparations for its culture, even to concreting the bottoms of the borders, and to restricting the roots to soil carted from a distance and carefully mixed and prepared before being placed in position. Such times have all passed, and unless a soil is in itself suitable for Vines, it will no longer pay to go to the expense of such special preparations. The Vine is a most accommodating subject, and will put up with very different treatments and yet give a fair return. Some growers devote houses entirely to them; many utilize the space under early Vines for Arums, and again in autumn for Chrysanthemums; while some may be said to make a catch crop of their Vines, and use the space underneath for forcing Spiræas, growing bedding stuff and Ferns, and for storing stock plants during the winter. It is very doubtful whether it can possibly pay to grow grapes under such conditions at the present day. Vines will grow well on a variety of soils. The Worthing soil is probably the best for the purpose in all England, and consists of a deep strip of good loam on a substratum of chalk or chalky marl full of flints. Here the roots have in many places fully 6 ft. of good loam to rove in, with good natural drainage into the bargain. A large grower in the north of London thinks the most suitable soil to be an old turf on a good loam with a brick-earth subsoil. The main point to consider is the natural drainage of the situation, so long as the soil is fairly good in other ways. Judicious manuring and cultural treatment will produce a good crop if the roots are running in a sweet medium. It may be said, therefore, that anyone starting in the glass industry with a view to making Vines a special crop should do his very best to get a really good soil and subsoil; and failing the best of soils as far as fertility is concerned, to make the natural drainage of the site the most vital point. Strict enquiries should be made as to the height the water stands at in the wells in the district, and the place should certainly be visited in the winter, and holes be dug on the proposed site to see if water lies within a short distance from the surface.

Having decided on the land, the first thing to be done is to drain the ground most thoroughly. If the lie of the land admits, a main drain should be carried along just outside the ends of the houses when they are up. This arrangement serves a double purpose, for provision is thus made for carrying off the waste water from the tanks and gutters and the drainage from the borders at the same time. It is not good practice in draining to take side drains into a main at right angles; but in such a case it cannot be helped; the fault can be minimized by having the last pipe of the branch drains curved. The main drain should be put at a good depth to allow of the branch drains down the site for each house being set at the depth of the border. Three feet would be sufficient for most soils, but if the subsoil is at all stiff and retentive, and lies nearer the surface than this, the pipes should be covered with clinker to the beginning of the surface soil, thus allowing free drainage without bringing the pipes too near the Vine roots. In the case of a stiff retentive subsoil it is a good plan to build the walls of the houses rather higher than usual, to allow of the borders being made up 1 ft. or so with extra soil. Where early work is to be attempted this is always an advantage, as the roots are much more under control. The number of drains to lay will depend entirely upon the nature of the soil and the width of the houses. The more retentive the soil the closer must be the drains. One drain down each border should be sufficient.

The question as to what is the best size of house for grape growing is the next to arise. Probably there are more vineries built 25 or 30 ft. wide for market purposes than any other width, though houses of 15 or 16 ft. are common, and Vines do very well in them. Above 30 ft. wide houses tend to become unwieldy, and the expense of building is considerably increased. Most of our leading nurserymen have, at some time or another, gone in for building giant houses, but in nearly every case they have returned to the more workable sizes. In the same way, the length of a house should not exceed 200 ft., as excessive length creates difficulties in the keeping up of uniform temperatures in all parts of the house, and also in the ventilation, and even the working of the ventilators themselves. In Worthing the favourite size appears to be 160 ft. long by 25 or 30 ft. wide. In the north of London the houses run somewhat longer, especially in the big nurseries, 200 ft. being common. From all points of view the most workable size is the Worthing standard. Another important point is whether the houses should be



Photo, E. J. Gear

A MODERN VINERY

One of Messrs. T. Rochford & Sons' Vineries at Broxbourne. This house produces 8 tons of grapes annually

built separately or in blocks, ridge and furrow, with no party walls. Here, again, the two great grape-growing districts differ: the Worthing men building separate houses to a large extent, and the North London men building huge blocks of thirty or forty houses enclosed by four walls, all the gutters resting on piers. If the writer may state an opinion, no house should ever be built without at least a thin partition dividing it from the next house, and full control over the hot-water pipes for each house. Some expense may be saved in the building, but the want of economy in the working of a block of houses all communicating soon outbalances the initial gain. For a grower in a very large way the system may have its advantages, but for the beginner in a small way it must be absolute folly.

Another great disadvantage in the working of these ridge-and-furrow houses is the increased cost of fumigating, for if one house starts a pest the whole block must be treated unless the house is temporarily divided. Again, the spread of insect and fungoid pests is greatly facilitated by the absence of division walls; and, last but not least, the very important matter of bottom ventilation crops up. There can be no question that the bottom ventilators in a detached vinery are more suitably placed than in the ridge-and-furrow system, where the bottom ventilation, if any, is in the gutters, or on or above that level. Taking everything into account, then, the best all-round house is one about 150 ft. to 200 ft. long and 25 ft. wide, built detached.

With regard to the heating of vineries, a house 15 ft. wide would want four rows of pipes; one 25 ft. wide, six rows; and one 30 ft. wide, eight rows—4-in. pipe in all cases. The boiler chosen should have power enough to be capable of working 25 per cent more pipe than the house or houses contain.

Although single houses are advised, this does not mean that each house must have its own boiler. It should be possible to cut out any of the houses without affecting the others heated from the same boiler; and there is no reason why several houses should not be heated from the same source. A favourite arrangement is to build houses in fives—four long ones and one short one in the middle. The space so left is occupied by the stokehole, containing two boilers for heating the whole. The boilers can be worked together, or, if it is only required to keep the damp out of the houses, one at a time; and, of course, one or two houses can be started before the others. Where each house has a considerable amount of piping, it is advisable to have larger mains from the boiler to ensure a free circulation.

The question of the cost of building glasshouses for grape growing is not particularly easy. So much depends on the style of house, and the situation, and the boiler chosen for the work. Without advocating the expensive style of building in vogue in Worthing, and considering the construction of houses in blocks, the following figures may be interesting. Houses 30 ft. wide, suitable for growing "Colmars" and built in blocks, would cost from 24*s*. to 32*s*. per foot run; fully equipped houses 25 ft. wide, fitted with iron-tube standards and cross stays, six rows of pipes, boiler, and ventilating gear, about 31*s*. per foot, and never less than 30*s*. per foot. All firms are willing to give estimates for any buildings contemplated, and the simplest and most satisfactory thing to do is to write for estimates after the site is decided upon, as this may make considerable difference to the cost.

Nothing but the soundest wood should be used, as the depreciation of a glasshouse is very rapid. Strength must not be sacrificed to cheapness, or a single gale may cause destruction. To be in a long glasshouse when a gale is blowing will impress this point more than any writing. Even when the house has every appliance for strength, the wind will cause waves to run along the glass, and if the purlin standards are not tied down properly they will be lifted from the piers with every gust.

Making the Vine Borders.—Presuming the style of house to be decided upon, and the building finished, the preparation of the borders should next receive attention. It has already been impressed upon the reader that commercial grape growing of to-day will not bear the extra cost of growing where the soil is not naturally suitable. However, there are cases where a grower may wish to put up a few vineries to supply a local demand, and in such a case it may pay him to go to the extra expense of preparing an unsuitable soil; therefore in dealing with the subject of border preparation this will be taken into account. To take the good situation first. Except in rare cases it will be necessary to provide some system of border drainage, and it may be necessary to lay a drain outside the houses as well, e.g. when the land is on the slope and natural drainage not very free it will be found in wet winters that there will be considerable soakage from the higher ground, sufficient to keep the borders of the houses wet on the uphill side. In such a case a drain should be laid to intercept this flow; and to make sure that the drain shall work well and rapidly the trench should be filled up with clinker till the porous top soil is reached. Thus the borders will be more under the control of the grower. Unless the soil is too wet to be suitable for grapes, the inside of the house will only require one line of drain to each border, i.e. a 15-ft.-wide house would have two drains running the length of the house, a 25-ft. house four, and a 30-ft. house six. These drains should be put 3 ft. deep, and should discharge into a larger main drain running along outside the lower end of the houses.

This being done, the preparation of the borders for the Vines may proceed. Digging two spits deep should be all the mechanical preparation a good soil should require; but unless the soil has a good supply of lime in it a heavy dressing of ground chalk must be worked in. In chalking land it is common practice to apply as much as 10 tons to the acre. This amount applied to a greenhouse border works out at 140 lb. per rod, or a little over 4½ lb. per square yard. This quantity may be spread over the surface or be thrown on the soil as it is turned up. When digging, the top soil is usually kept to the top, the bottom spit being merely turned over and broken up. When the trenching is done, a good dressing of old hot-bed manure or any well-rotted manure should be pricked into the surface soil, and at the same time a dressing of some good complete artificial manure may be given. The borders should then receive a good watering and be left to settle down.

It is always advisable to get an analysis of the soil when taking a fresh place; expert advice as to the manure actually required can then be obtained. Many growers when making up their borders use a great quantity of bone meal. This manure certainly forms a lasting supply of phosphates for the roots to draw upon. The famous pastures of Cheshire were made fertile chiefly through the large dressings of coarse bone applied to them years ago; 1 ton or more per acre of roughly broken bone would be spread on the land and rolled in. This quantity works out at 8 oz. per square yard, and if the grower intends to apply it it can be spread on the surface before the trenching is begun, bone meal being used instead of the broken bone.

Now with regard to the preparation required where the situation is not really suitable. Supposing that there is a thin soil of only about a spit depth above a stiff retentive clay, or a subsoil full of water which would be unhealthy for the roots to run in. In such a case the best possible thing to do would be to build the walls of the houses high enough to allow 2 ft. of extra soil to be put on the borders. Readers must bear in mind that these directions only apply to the extreme cases mentioned; unless unlimited soil was obtainable it could not be done on a large scale.

Before bringing in the extra soil the borders should be taken one at a time, the soil thrown out to the depth of 1 ft., and a drain laid right down the length of the house, and then the whole bottom of the excavation covered with clinker to the depth of 3 in. The top soil is then returned, chalk and bone meal being thrown over it beforehand. Each border is treated in the same way and the drains taken off into a main as already described. When the whole house has been prepared in this way the extra soil can be wheeled in and spread and dressed as before. Provided the soil is available, this is not such an expensive business as it may appear; for drain pipes cost little and clinkers can be obtained at most destructor works for 6*d*. per cartload, and also from gasworks, though the price may vary a little. At some destructors the clinkers may be had for the carting away. Vine borders formed in this way will be under the complete control of the grower, and should be both warmer and drier than those formed on a level with the soil.

Reverting to the ordinary procedure, it is usual only to prepare the back borders the first year, and the remaining borders the second and third year till the middle is reached. In this way freshly prepared soil is available for the young roots till they occupy the whole space under glass.

Although for market work it is more usual to provide only inside borders, there are some growers who make outside borders as well. For mid-season grapes this works well if the land for the purpose can be spared; but for early or very late work the inside borders are best, because the watering is under control and the borders are warmer, which is especially important for early work.

Planting.—The borders having been made ready, the planting is the next thing to consider. Planting is done in the autumn or early spring, two-year-old canes being used for the purpose. These are planted at 1 ft. from the wall, holes being prepared about 3 in. deep and wide enough to take all the roots when carefully shaken out and spread fanwise over the border. The soil is carefully spread over the roots and well firmed down. If nicely moist no water need be given, but if the soil has got dry while waiting for the canes they must be watered in. The distance apart at which the canes must be planted will depend upon the variety, in the first place, and on the number of rods it is proposed to take from each Vine. Strong growers, like "Alicante" and "Muscat of Alexandria", will require 3 ft. between the rods, while "Black Hambro" will do with 2 ft. 6 in. Some growers only allow 2 ft. between the rods, but this is scarcely enough if the Vines are to grow well and last any time. There is no doubt that the Vine does best and lasts longest when grown on the "extension system"; but in market houses it is the rule to limit the Vines to two rods each, and very often only one rod is allowed. One large grower in the north of London district, who is famous for Canon Hall Muscats, allows up to seven or eight rods to a Vine for that particular variety at any rate, believing that the plants are healthier grown that way. Very fine fruit is grown on the single-rod system, and in Worthing it is the usual practice. However, where a tank comes a Vine is very often seen with three or more rods, and no appreciable difference in the fruit can be noticed. Roof space can be covered more quickly by the single-rod system; but as Tomatoes are grown under the Vines till the roof is covered it amounts to the same thing in the end. If more than two rods are to be grown, temporary single-rod Vines can be planted to fill up the space until it is wanted for the permanent Vines. In the case of double-rod Vines the two rods are trained up at the same time, but if more are to be grown two would be started first and the others taken from their bases afterwards. These remarks apply to the planting of wide houses. In the case of the 15-ft. houses, at least two rods should be allowed to each Vine, as the roof space is so small.

Wiring.—While the subject of the rods is under discussion it will be as well to glance at the question of the wiring. There are two ways of doing this: one is to have the wires running horizontally and the other vertically. Each system is largely used, but the vertical way is perhaps to be preferred. The advantages are as follows: the rods are easier to train straight up the roof, as they lie along the wire all the way and can be tied at any point. With a gross-growing variety, like "Alicante", the wire to which the rod is to be tied may be set 6 in. lower than those for the laterals. This helps to prevent the laterals being broken out when tying down is in progress. Lastly, the operation of glass washing is greatly facilitated. The wires for Vines should be set at 18 in. from the glass. In the horizontal method the wires are strained between two lengths of angle iron properly fixed and stayed at each end of the house, and supported at intervals of about 15 ft. up the house by lengths of scroll iron 1 in. by $\frac{1}{8}$ in., the length of the rafters, and slung from them by short pieces of the same material. The long pieces are bored at intervals of 9 in. to take the wires. In the vertical method screw eyes are put along the lower edge of the ridge, one for each rod and one for every space between. From these are hung wire hooks long enough to support the wires 18 in. from the glass. A piece of $\frac{3}{4}$-in. gaspipe is bolted to the wall at short intervals, with eye bolts passing through the wall and screwed up from the other side. A strong wire is run right along the house under each purlin, generally passing through holes drilled through the purlin standards; these are to support the vertical wires when loaded with the crop. The wires are now fixed to the gaspipe on one side of the house, taken right over the hooks in the roof and strained tight to the gaspipe on the other side, passing over the horizontal supporting wires on the way. Whatever number of rods is decided upon, the first thing to do is to cut back the young canes level with the bottom wire in the horizontal wiring and to where the canes meet the wires at 1 ft. from the wall in the vertical wiring, leaving them just long enough to be tied to the wire. Whatever crop is grown in the houses while the young canes are covering the roof, the house must be treated as much as possible as a vinery, and on no account must red spider be allowed to obtain a footing. Tomatoes are usually grown under the Vines for three years, in spite of the fact that the atmosphere suitable for the one is most unsuitable for the other. However, the Vines must receive the first care and the Tomatoes take second place. Roses do well under young Vines, but pot plants are not the best thing to have, as the frequent watering required is apt to produce sour borders.

The young canes should be allowed to start into growth naturally the following spring. When the buds on the young canes show signs of swelling, a light syringing should be given twice a day to help them to break; but as soon as the leaves begin to open out, the syringing should be stopped and the canes be damped over with a sprayer instead. All the buds should be allowed to break, and when three leaves are formed the growths to form the rods can be chosen from near the top of the canes and allowed to run on while all the rest are stopped at the three leaves. Some growers rub out all buds except those they want for rods at once, but if three leaves are left to each shoot the roots are encouraged at once and the vigour of the cane is not sapped in any way by the extra growth. The selected buds are allowed to grow on up the roof, all side shoots that form being stopped at once. When the young rods reach halfway up the rafter they should have the tips pinched out and then be allowed to run on again. As the season advances they may be allowed to make a few side shoots near the top. When dressing the crop that is growing underneath, the Vines should get their share of the manure. As soon as the under crop will allow, at the end of the season, full air should be given except in stormy weather, to ripen off the canes. When the leaves are dead, and the sap has stopped flowing, cut back the young rods, leaving 3, 4, or 5 ft. of rod according to strength and ripeness. The wood left should be as thick as the forefinger and thoroughly well ripened. The following year this piece may be lightly cropped, and the young canes run up as before and pruned when dormant, according to strength as in the first year, the laterals which will have been formed on the previous year's growth being cut back to one good prominent bud, or two to be on the safe side. When the buds break the following spring the stronger can be selected and the other rubbed out.

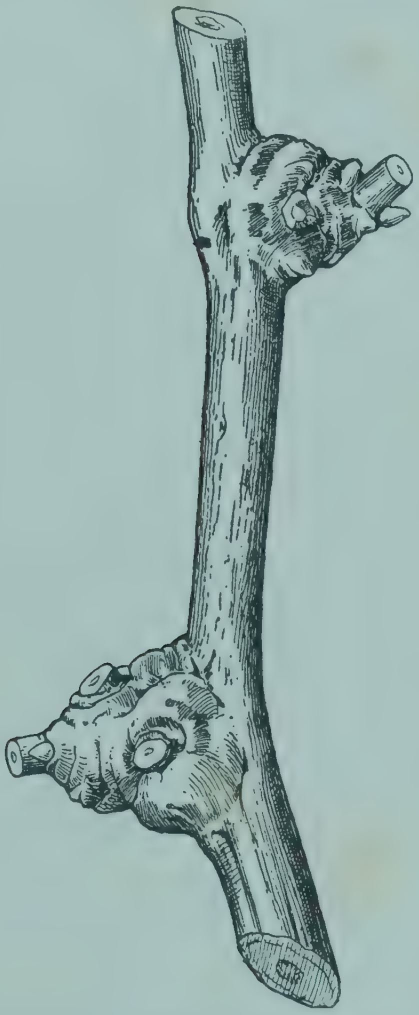


Fig. 381.—Spur-pruned Three-year-old Vine Stem

Pruning, &c.—Having indicated the method of growing on the young rods we now come to the regular treatment of a fruiting vinery. As soon after the leaves have fallen as possible the Vines can be gone over with secateurs and all the laterals be cut off—leaving about three buds—and all leaves and rubbish be cleared out. The rods are then cut loose from the wires during the winter and carefully cleaned. On young rods especially a lot of loose bark is formed. This should be removed, and all of it that is fit to move will come away when the hand is rubbed round the rod. On no account must it be peeled or scraped off so that the green skin of the rod is exposed. Special attention should be paid to the eyes, for if any Red Spider has been present during the growing season, it is here that the dormant colonies will be found in little red masses under any loose bark there may be. When the rods have been gone over, the pruning may be finished off, using a sharp knife and cutting the spurs back to two buds as before directed. During this operation all pieces of dead spur left the previous season by disbudding should be removed and carefully cut off level, for it may be further explained that where two buds are left at pruning, and then the bud nearest the rod left to make the lateral the following season and the other rubbed out, the piece of bare spur so left dies back to the growing bud. When the pruning is done the rods should be gone over with a solution of Gishurst compound, or the common lime-and-sulphur wash may be used instead. An old paint brush is used for the application. The formula for the lime-and-sulphur wash is as follows: 3 lb. of lime, 3 lb. of sulphur, and 10 gall. of water. The lime is selected from good freshly burned lumps, and slaked with some of the water and mixed to a cream; the sulphur is then added, and the remainder of the water, and the whole boiled for a couple of hours. This dressing will be found deadly to any of the pests of the Vine it comes in contact with. While the rods are down the glass and woodwork should be thoroughly syringed and washed down, usually with a little carbolic or some similar preparation. At the same time the walls should be sprayed with hot limewash containing a little of the disinfectant used. The rods are then tied up, using tarred string and leaving so much of the upper part of the rods untied as will allow the tips to hang down as low as possible without obstructing the path. This is to ensure even breaking of the buds. Vines should not be forced till they have made their full growth, but when forcing is in contemplation there is a special method of tying down which is dealt with further on at p. 192.

Borders.—The borders must next receive attention. These are scraped clean of every scrap of rubbish, such as bits of bark which have fallen on them during the cleaning of the rods, which work should have been done over a piece of canvas laid on the border to catch the fine rubbish. A dressing of complete manure, at the rate of 3 oz. per square yard—or a good guano may be used instead—also a dressing of ground chalk, enough to whiten the border all over, or basic slag at 3 oz. per square yard should be pricked into the back borders and dug lightly into the other borders. A good complete manure for the purpose is made by mixing 2 parts superphosphate with 1 part each of sulphate of potash and sulphate of ammonia. The dressing of ground chalk is added to correct any acidity of the borders and to assist in the proper working of the other artificials. If the grower likes, he can use instead basic slag, 1½ oz.; calcium cyanamide or nitrolim, ¾ oz.; and sulphate of potash, ¾ oz. per square yard. These manures can be sown separately or mixed up together in the following proportions: 5 cwt. basic slag, 1½ cwt. sulphate of potash, 1½ cwt. nitrolim. This at 3 oz. per square yard makes a good dressing, and has the advantage of being alkaline. Some growers give a lot of bone meal and other special Vine manures, which are sold ready mixed and generally at a price far beyond their value. The grower is well advised who has his soil analysed and takes expert opinion as to the manures required for it. Most nurserymen use enormous dressings of artificials without any consideration as to whether they are wasting money and material. If the soil is inclined to wash when watered, i.e. to run close together and refuse to take further waterings without being pricked up afresh, it is a good plan to give a mulch of spent mushroom manure; this will keep the border nicely open and moist. Most growers like to give a mulch of well-rotted manure at some time during the season, and a favourite time is after the stoning time, when the berries begin to swell again. One disadvantage of this practice is the number of little flies which immediately cover the glass and the grapes, marking the latter badly and detracting seriously from their appearance. If this mulch must be put on, it is better to do it when the Vines are started.

Starting the Vines.—A fortnight before the Vines are to be started a good watering is given if the borders are dryish. The house is shut up and kept close to induce the sap to begin to move. At the end of the fortnight the heat is turned on gently and another watering with warm water given; unless the Vines are being started naturally, when cold water will do at all times. The rods are syringed twice a day, and the best tool for the purpose is one of the knapsack sprayers, fitted with a Mistifier Junior spraying nozzle. This nozzle can be adjusted to give a jet very like a syringe, and the saving in time and the avoidance of the sloppiness of the syringe is well worth the outlay. To ensure the rods being thoroughly wetted the house is worked both ways. The night temperature at this time should be from 45° to 50° F., giving a little air at 70° F. during the day. As the Vines break, the spraying is discontinued on all but bright days, or the buds will sometimes rot out, and the night temperature is gradually raised to 55°. When all the buds are fully broken the spraying is discontinued, and the borders are damped down through a fine rose. As little water should be used as possible as long as the surface of the borders and the pipes are damped all over. This should be done every morning, and on bright days twice or three times according to the state of the air in the vinery, the last damping being given when the house is shut up. This should be done about an hour before the sun is off the glass. As growth proceeds the temperature is raised to 60° to 65° at night and 75° by day, with air being given at that temperature in mild weather. Cold draughts must be avoided; and the particular bugbear of the grower is an east wind and a hot sun, such as is often experienced in the spring. The only thing is to give just so much air as possible without draught, keep the pipes as cool as possible, and damp down frequently. As soon as the buds have broken, the rods are tied up into place, and any buds which are not required rubbed out, leaving the one nearest to the rod if possible, i.e. if it looks strong and likely to fruit well. When the laterals are long enough to show three leaves beyond the bunch they should be stopped at that point, and about ten days after be tied down. Private gardeners only bring the laterals down part of the way at the first tying, but the market man generally does it in one operation, and a careful man will do it without breaking out any laterals worth mentioning. Alicante is a bad variety to tie down, but if the house is wired as advised for it little difficulty will be experienced. The lateral, if difficult to get down, should be steadied at the base with the thumb and finger of one hand while it is gently bent down by the other hand. Sometimes by giving a gentle twist to a refractory lateral it can be brought into position quite easily.

Soon after the tying down is done the Vines will be coming into flower (fig. 382), and at this time the damping down must be withheld, except in the mornings of bright days, and the temperature must be raised at night from 65° to 70°, the temperature for Muscats being in all cases a few degrees higher. The rods should be tapped with the closed hand about the middle of the day to make the pollen fall and fertilize the fruit. Muscats want a little more attention in this way, and it is a good practice to go over the Vines with a very fine spray as the sun begins to rise, and then, when there is a nice chink of air on in the middle of the day, tap the rods as before. Canon Hall Muscat

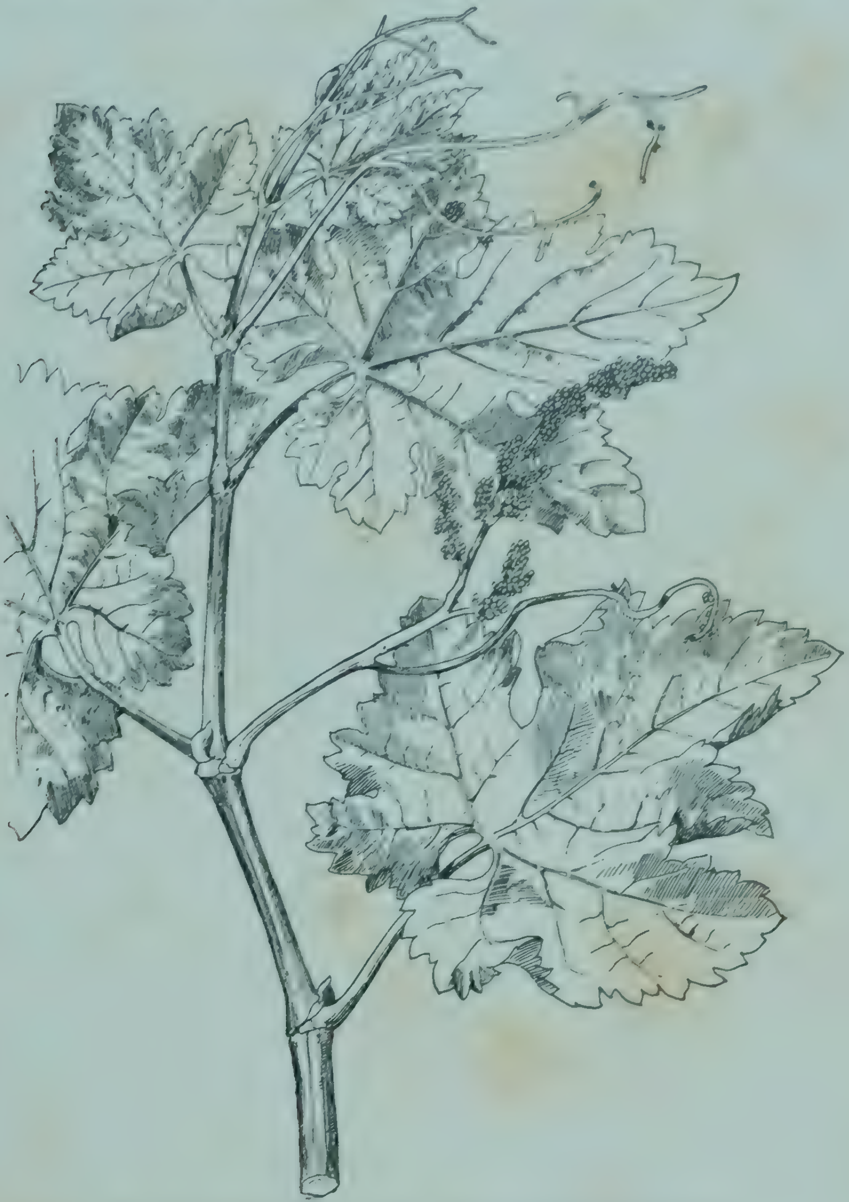


Fig. 382.—Young Shoot of Vine, showing position of Flowers

is very difficult to set well, but some growers have the knack of it. One method in use by a large grower is to get the temperature up to 90°, then go round the bunches with a soft piece of a boa or rabbit skin and gently pass it over each bunch that is ready, and follow this up with a light spraying of the bunches and a damping down of the border. The reason some grapes are shy of setting is because the stamens in those varieties fall away from the stigma (fig. 383, *b*) before the pollen is shed; and it seems reasonable to suppose that any treatment that would make the stamens remain erect would be likely to ensure a good "set", and the moist heat generated by the spraying when the house is hot would cause the pollen which had fallen upon the stigmas to commence growth at once. After the blooming is over the damping down must be resumed, and the temperature may be reduced to what it was before the appearance of the flowers.

During all the growing time of the Vines strict attention must be paid to keeping down all side-growths from the laterals—sub-laterals as they are called. These are stopped at one leaf, and the same every time they make fresh growth. If the leafage threatens to become too thick, they may be kept stopped altogether. All such growths are best stopped before they require anything more than the finger and thumb to take them off.

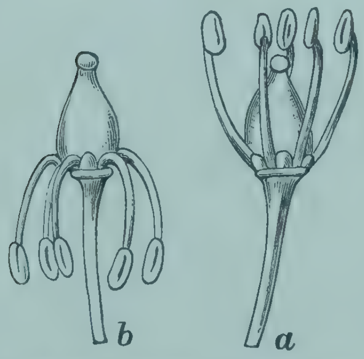
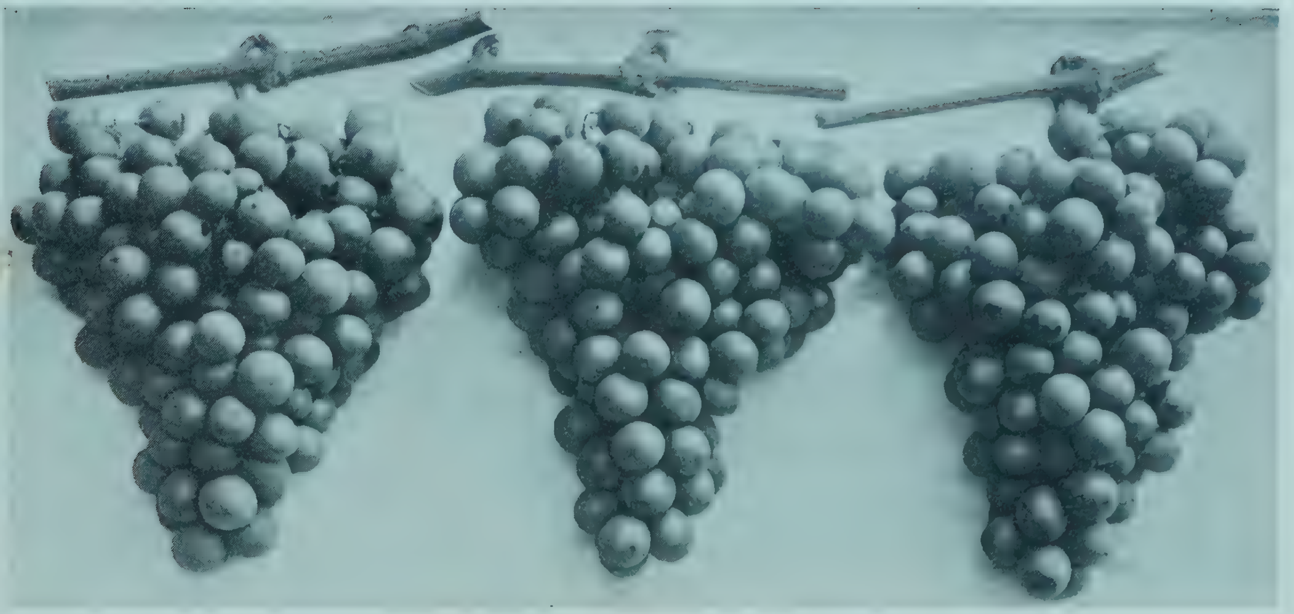


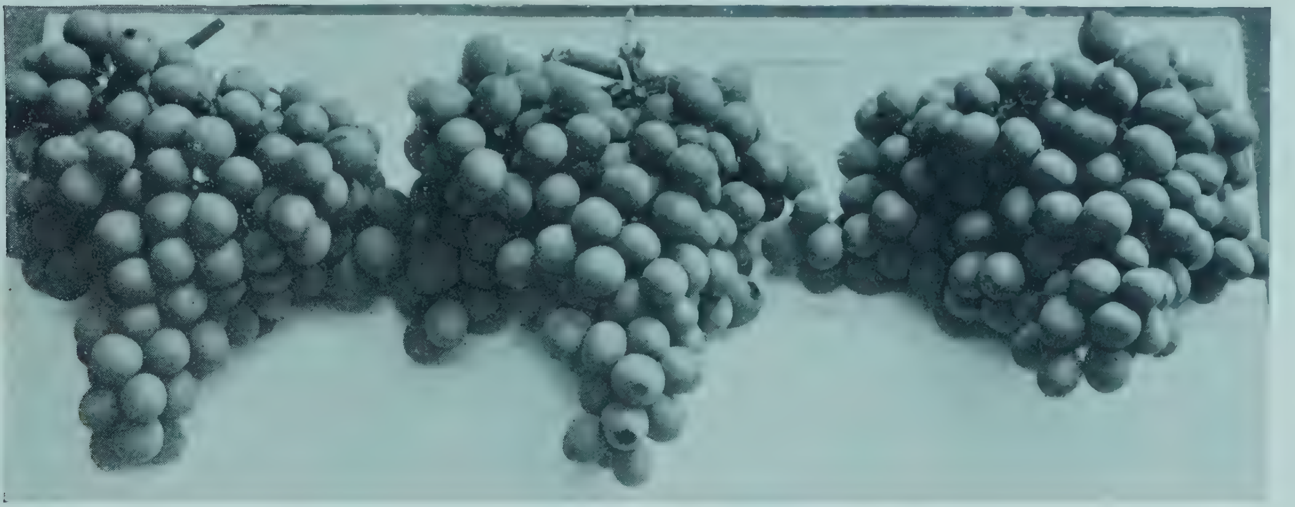
Fig. 383.—Flowers of Grape Vine (× 4)

a, Erect stamens, free setting.
b, Deflexed stamens, shy setting.

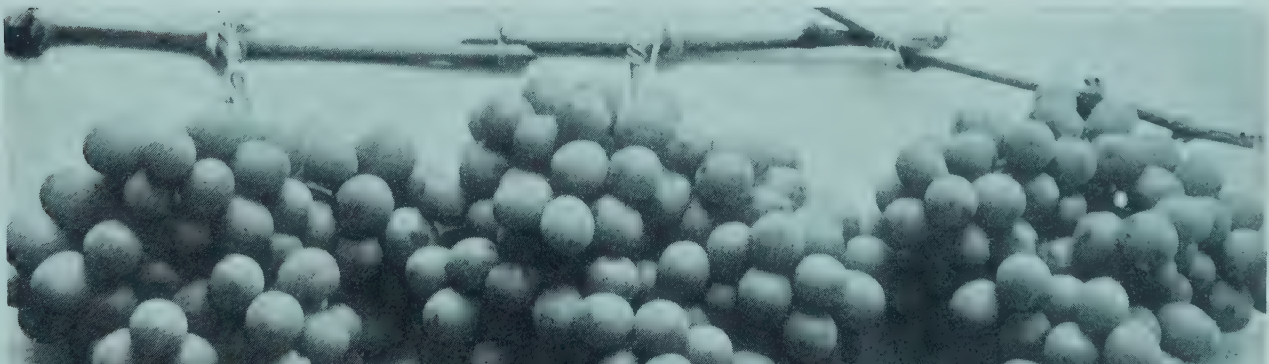
Thinning.—As soon as it is possible to see the character of the bunches they must be thinned out, leaving only one bunch to a lateral, and it is best to remove straggly shoulders from the black varieties; the Muscats generally have them left on. The thinning out of the Muscat bunches is generally left a little longer, so that the set can be judged better. As soon as the bunches have berries as large as BB shot, the thinning should be taken in hand. For this purpose there is nothing much better for holding the bunches still while the berries are being thinned than a piece of a bamboo cane about 6 or 9 in. long, cut with a neat little fork at one end and the rest of it shaved down to a fine handle. A good thinner will finish a bunch (fig. 384) at one thinning, and this should be the aim of everyone who undertakes the job. The expense of the operation is considerable, and it is a pity to have to repeat it. No market house should want more than just looking over for a few thick bunches after thinning. To get a bunch just right the thinner must carry in his head an idea of the size the finished berry should be, and enough berries must be left so that when the bunch is cut and laid on a plate it will retain its shape. This is a most important point, for a loose bunch will never travel well when sent to market. Alicantes are a great trouble to thin, as they set so thick that, unless the thinning is carried through quickly, the bunches get so tight that it is almost impossible to thin them. Muscats will bear being left longer than



MUSCAT OF ALEXANDRIA, A WHITE LATE MARKET GRAPE



ALICANTE, A BLACK LATE MARKET GRAPE



(46)

BLACK HAMBRO', A BLACK SWEETWATER EARLY MARKET GRAPE

BUNCHES OF GRAPES CUT FOR MARKET

other sorts, as the bunches are of a more straggly character than those of the black varieties.

Soon after the thinning is done the berries finish their first swelling and begin to stone. During this process it is useless to try to drive the Vines in any way, and it is usual to reduce the temperature a little. Immediately it is seen that the stoning is finished, and the berries are beginning to swell again, opportunity should be taken at the next watering to give a little stimulant of some kind, and this should be repeated at intervals of a fortnight until the grapes are colouring. This practice is carried out on some of the Worthing nurseries, and the soil there can apparently take water at all times without getting too wet. On a good many soils frequent watering cannot be done, and the only guide to the cultivator in the matter of watering Vines is only to do it when required, and this can only be decided by intelligent observation of the borders. Vines can take a great quantity of water at times, and must never be allowed to suffer for want of it; but too much water—entailing as it does unhealthy border conditions—is worse, if anything. As soon as the berries begin to show colour more air must be given, and a chink should be left on all night until, as the colour gets to be pronounced, free ventilation can be left on night and day except in bad

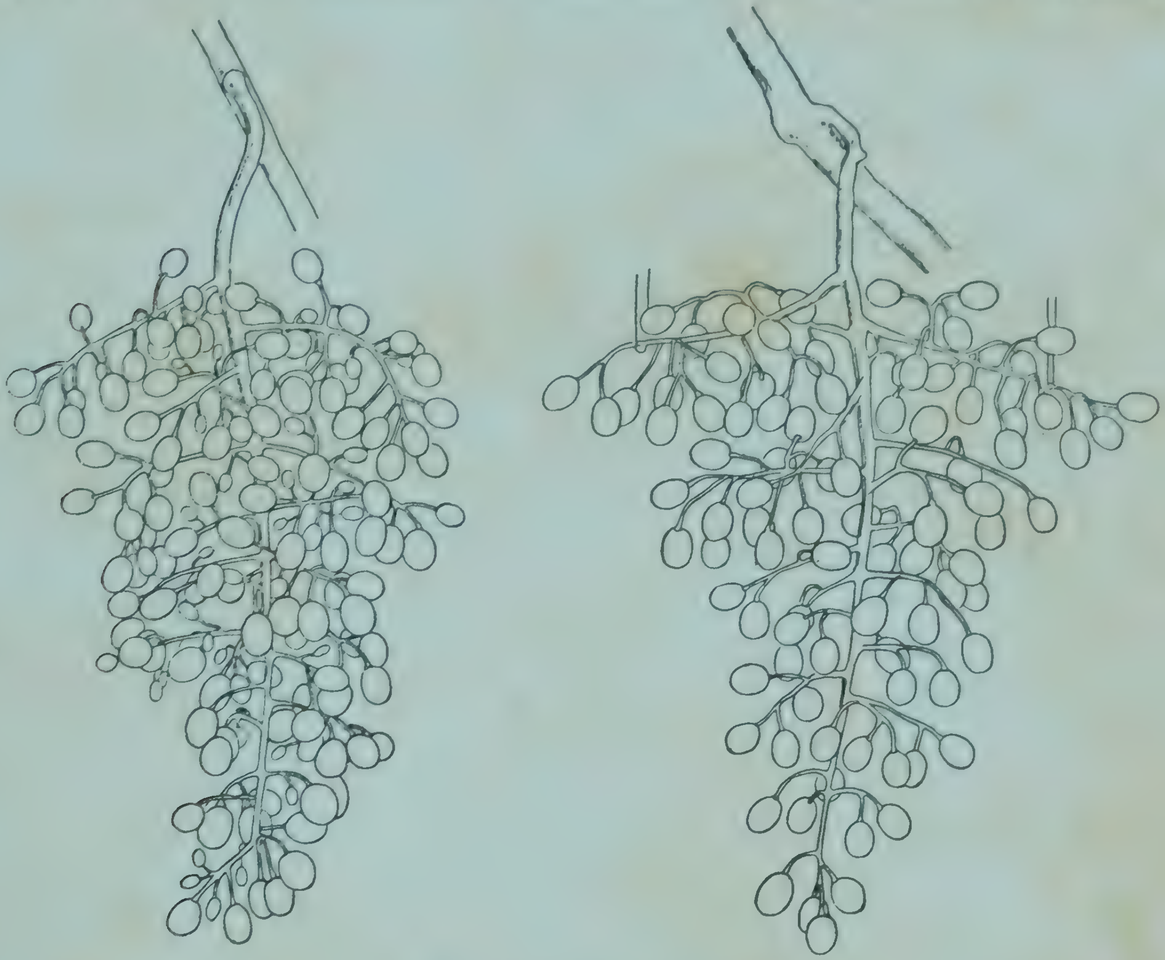


Fig. 384.—Young Bunches of Grapes

1, Before, and 2, after thinning.

weather. Damping down must also be reduced, and left off entirely in all but early vineries, where considerable fire heat still has to be kept up. In mid-season vineries the fire may be left off altogether unless the berries are seen to be suffering from rot, as they will in damp weather. With late grapes the pipes must be kept just warm; but for keeping grapes very late, after the leaves have fallen, great care must be exercised with the firing, and no more than enough to keep the air dry must be allowed, or the grapes will shrivel and lose weight to a great extent. A temperature of 45° will be sufficient in such cases.

Forcing.—When it is desired to start Vines early, the change must be gradual; it will not do to make a violent alteration in the time of starting. If a house is started a month earlier each year it will be quite change enough. It is a question whether it pays to force Vines very early at the present time. Prices are very low and firing is dear; added to this, no more than half a crop can be expected, and the strain on the Vines soon tells. Some growers force their Vines for a few years and then gradually start them later to give them a rest, taking other houses for the earliest work. Where early work is done the rods must be tied right down low to induce them to start evenly, and in some places they are bent to one side till the end can be tied to the bottom wire about half the length of the rod along; in this way the rod forms a bow, with the middle of it the highest point. As soon as the buds have broken well the rods are tied up in the ordinary position. The easiest variety to force is Black Hambro, and it is the quickest to come to maturity, five months being sufficient under skilful growing and favourable conditions. Muscats can also be forced, but require a month longer to mature. The amber colour in these grapes is all-important, and that is what is so hard to get; but unless it is got the grower will be sadly disappointed with his returns. Air and light and sufficient time to finish must be given.

For forcing grapes a supply of warm water for watering is essential. This can be provided by running one of the hot-water pipes through the tanks. A layer of hot water will be formed in this way, and by stirring up, the cold edge can be taken off the whole. A more up-to-date method is to have the water supply so arranged that the water can be passed through the boiler before passing into the house. By keeping up a little extra fire a good supply of warm water can be got without lowering the temperature of the house by cooling down the hot-water apparatus. Where the pulsometer pump is used, the chill is taken off the water without any further trouble.

Gros Colmar is grown in very large quantities for late work, and Alicante, from the toughness of its skin, is very useful for the purpose. When very late work is attempted the Vines are allowed to start quite naturally; and as long as the colour is obtained before the leaves turn, they are not hurried in any way. Some very poorly coloured Colmars are seen on the market in some seasons, owing to the withholding of a little fire heat to help out the colouring at the end of the growing season.

When the natural covering of leaves falls, if grapes are to be kept for any length of time the houses must be covered with canvas to exclude the light and prevent shrivelling. Under the most careful conditions, one very large grower gives it as his opinion that grapes kept till March will lose weight to the extent of 25 per cent.

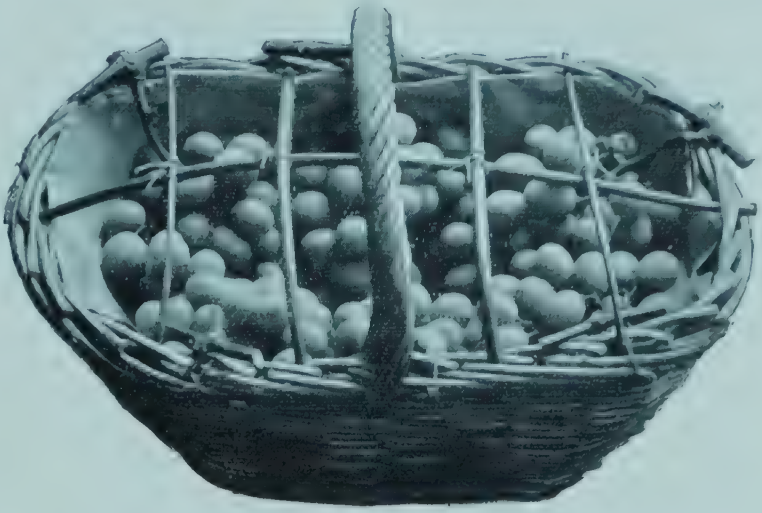


Fig. 385.—Grapes in Handle Basket hooped for Paper Covering

Marketing.—Grapes, in spite of their perishable nature, can be sent to market in very perfect condition, the method of packing being varied to suit the distance they have to travel. Where the market is close, and the grapes can be delivered by the grower's own vans, the grapes can be packed in wicker baby baskets, or shallow boxes suitably padded with wood wool covered with tissue paper. About 11 lb. can be packed in a baby basket, which in its turn is lowered into a cucumber flat, which will just take it. Tons of grapes are marketed in this way, though if they are sent by rail they are liable to receive damage at the hands of porters, who will sometimes carry a couple of flats hanging vertically, one in each hand, to the utter disregard of their contents. This actually happened to some of the writer's grapes, and, although each bunch was tied into the rim of the basket, the lot were utterly ruined, and with no prospect of redress from the company.

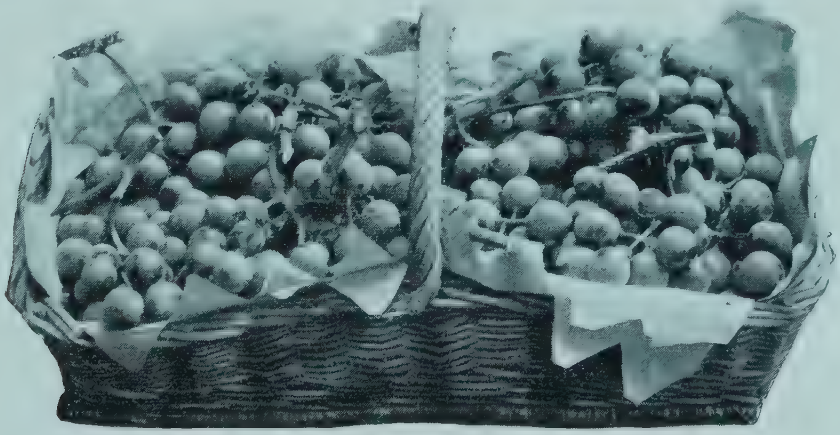


Fig. 386.—Grapes in Shallow Handle-basket. Packed with paper

For sending long distances there is nothing to beat the cross-handled baskets (figs. 385, 386), as the salesmen supply them, or in one of the numerous forms of chip non-returnables now on the market. These chips will hold as much as 7 lb., according to the size and solidity of the bunch and the amount of packing put in. The chips should be lined with wood wool covered with tissue paper, and the bunches should be put in as tightly as possible without crushing, and each bunch tied to the rim of the basket by a piece of raffia. For shorter journeys the raffia tie may be dispensed with if care is taken to pack the grapes closely. Since adopting these non-returnable chips, the writer has never had a case of damage during the journey to market. Another most important point, which it seems almost shameful to have to impress upon growers, is that packing must be absolutely honest. It is wonderful how well second-rate grapes will look when nicely packed so as to hide the worst side. Whatever the quality, it should be labelled so that no mistake can be made, no matter how nice the sample looks on the top; and if they sell for their appearance no one is to blame in the matter. The buyers will soon get to know which sender they can trust, and so, if for no better reason, "honesty is the best policy".

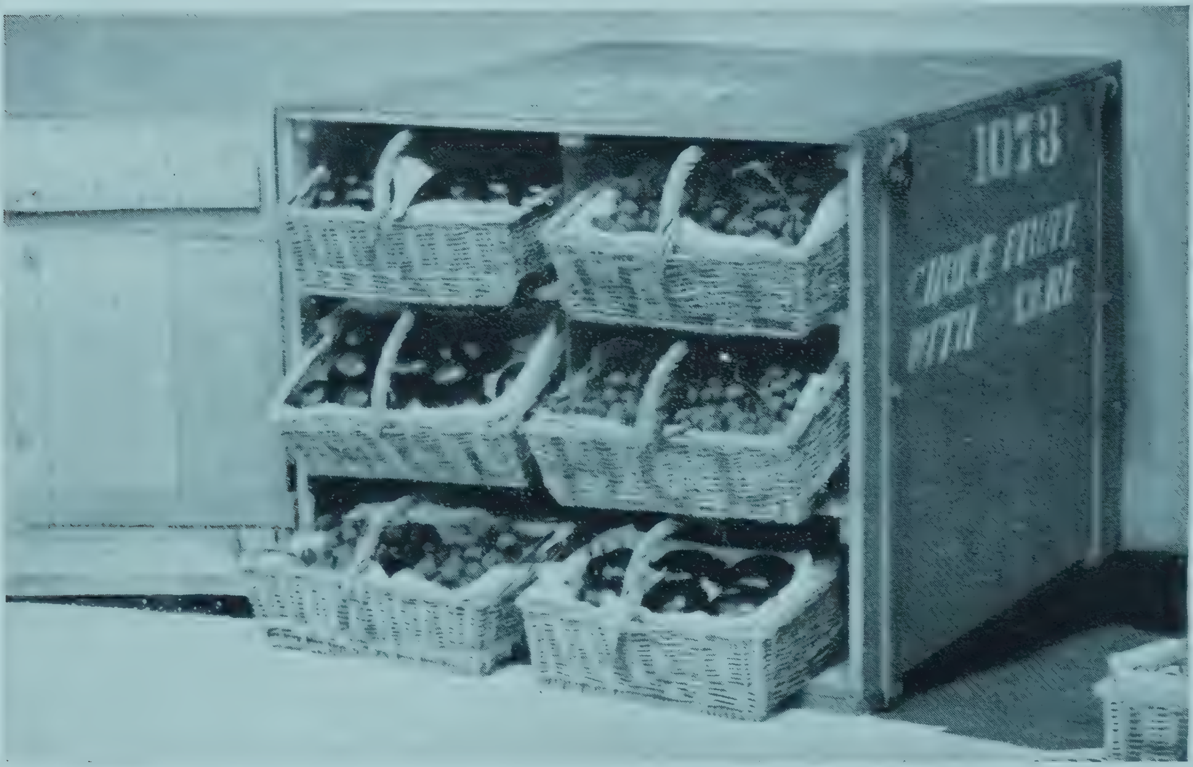


Fig. 387.—Grapes and Tomatoes in flat handle-baskets as packed in crates in Channel Islands

Channel Island growers pack their grapes in small handle baskets, several of which are placed in a strong wooden case bound round with iron bands (fig. 387). These cases are slung by cranes from the wharf on to the ship by means of chains or ropes fixed in the iron rings at the corners, each case being marked as shown in the illustration, or labelled "Grapes, with care" and "Lift with the crane"—the latter injunction to avoid rough usage at the hands of those who load the vessels. Fig. 388 also shows a crate of grapes packed for sea transit.

Propagation.—The raising of Vines for planting is a simple matter. Good, strong, well-ripened laterals are selected from Vines which have shown good bunches, and have ripened their fruit well in previous years. From these, short pieces are cut out with a sharp knife, each piece being furnished with an eye, or the bud which will make the next season's growth. The cuts are made slanting and at about ¾ in. above and below the eye, the knife being started on the side of the lateral beneath the eye, and carried through in a slanting direction away from the eye, so that when finished the eye is on the longest side of the short piece of lateral so cut off.

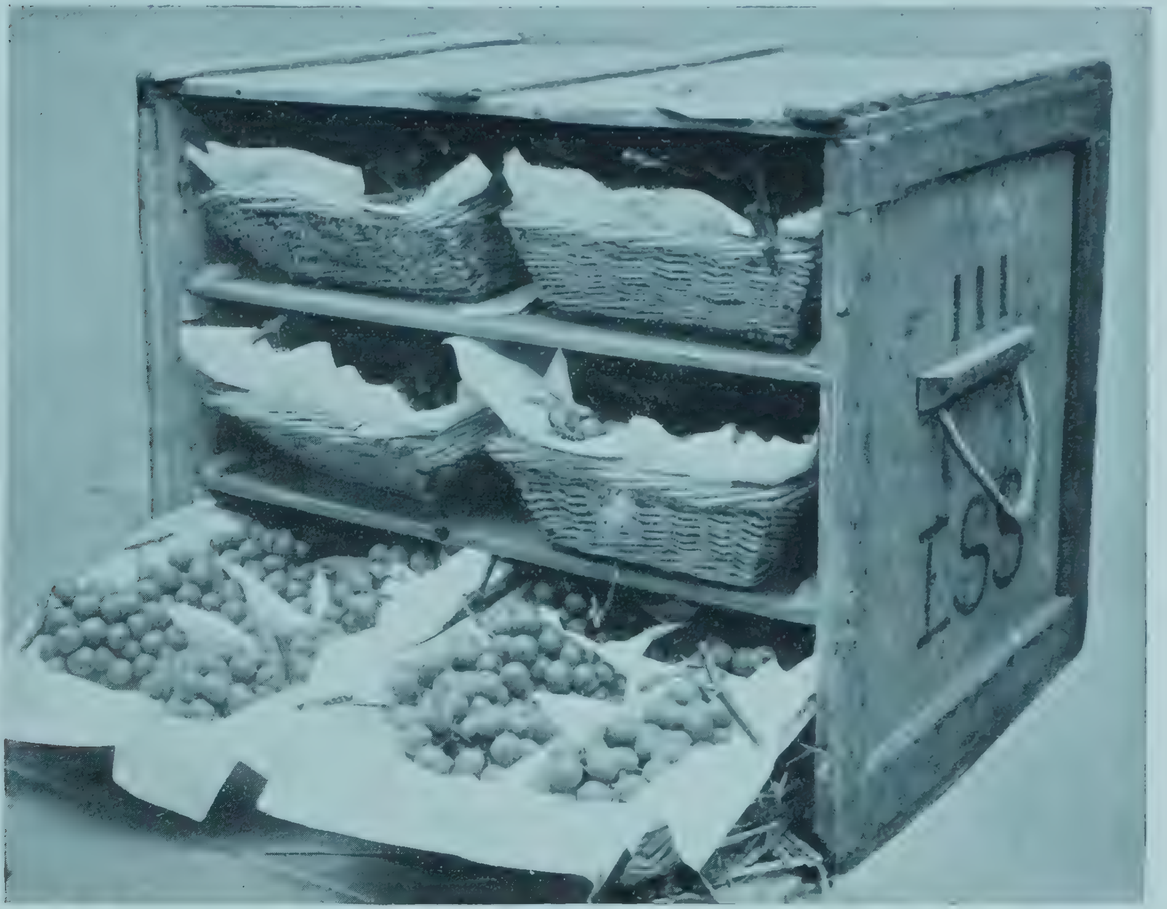


Fig. 388.—Grapes packed for Sea Transit

The propagation is carried out in the spring, and the laterals saved for the purpose are heeled in under a wall, or in some sheltered position, until they are wanted for preparing the eyes.

For striking the eyes, boxes are filled with nice light soil and a layer of sharp sand is sprinkled over the surface; the eyes are pressed into the soil, lower end downwards, and well watered in, and when this operation is finished the little bud should be just showing above the surface of the sand. The boxes are stood in a Cucumber house, or propagating pit, where they will soon show signs of growth. Watering must be carefully done, but the eyes must never be allowed to suffer for want of it. As soon as roots are formed (fig. 389) pot into small 60's, and as soon as these pots are full of roots, pot on into 48's or 32's according to the growth made. When potting, care must be taken to have the pots and the soil warmed, and the watering must be done with warm water, so that no check may be given to the young Vines. A 4-ft. cane is put into each pot, and the young growths trained up them till they reach the top, when they are stopped. As soon as the plants are well rooted, liquid manure may be given every other time of watering. The soil for potting may consist of 2 parts good loam, 1 part short manure, a little sand and a little bone meal. The potting must be done firmly but carefully. After potting into these larger pots the young plants are stood in a vinery which has part of the roof still uncovered. Here they will get enough light and just the right conditions for growing. About the end of July or in August the pots can be stood outside, and are best plunged in the soil to economize the watering. Before very cold weather sets in the canes are pruned to three eyes, and the pots stood in a cold house. The following year the Vines are potted on into clean, well-crocked 16's, started in gentle heat, and grown on as before, all buds but the strongest one being rubbed out as soon as choice is possible. At the end of the growing season the pots are stood outside as before, and when pruning time comes the canes are cut down to about 1 ft., according to their strength.

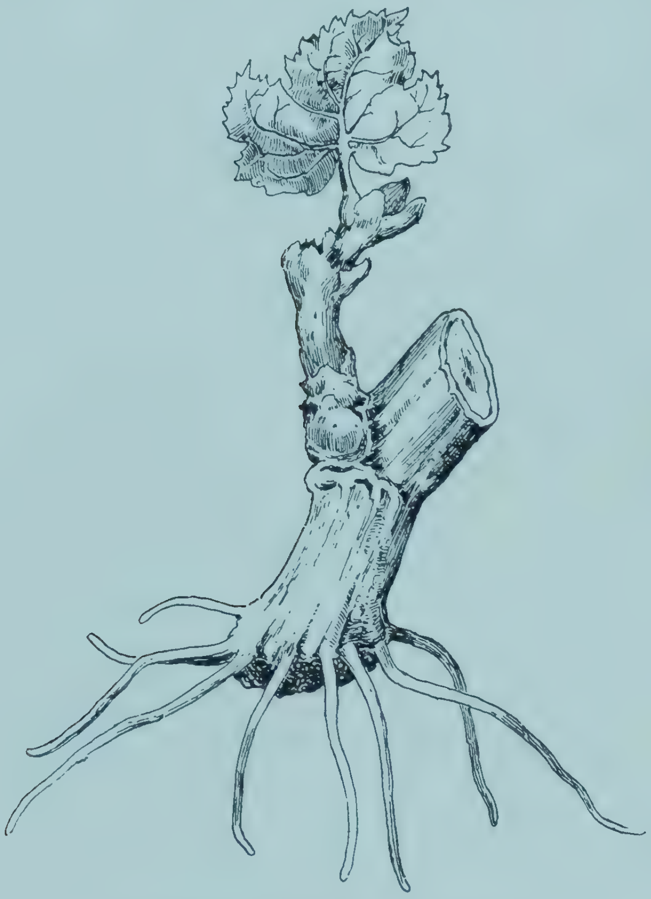


Fig. 339.—Eye-cutting when Rooted

§ 2. COST, RETURNS, ETC.

Information as to the weights of crops and the cost of growing is very difficult to get. The labour of keeping the necessary accounts is very great, and is very rarely undertaken by any grower. The largest of our growers may know just what their crops cost them, but prefer to keep the figures to themselves. One large grower in Worthing gives the average weight of crop for Black Hambro, Gros Maroc, Muscat of Alexandria and Canon Hall, as 1 lb. of grapes per foot of rod, and for Alicante and Gros Colmar about 1¼ lb. per foot. Another grower gives the cost of well-grown grapes as about 6*d*. per lb. The accompanying table shows the averages of prices obtained for grapes during the last two years. The great difference in the prices of early grapes for the two years given is largely due to the death of our late King; but the price of grapes has been steadily declining every year. At the present time Muscats hold their own fairly well, while Hambros and Gros Maroc scarcely pay to grow. The average weights given above are probably low. My own average crop over a period of five years works out at over 1¼ lb. per foot of rod for Hambros, and my soil is a very poor one for grapes. As to the cost of growing, my records bear out the estimate of 6*d.* per pound almost exactly.

	Hambro.		Colmar.		Alicante.		Muscats.	
	1909.	1910.	1909.	1910.	1909.	1910.	1909.	1910.
January ...	—	—	1/9	1/2½	1/9½	1/1	4/10	3/4
February ...	—	—	1/11	1/5	2/	1/2½	3/9	3/9
March ...	—	—	1/11½	1/10	1/11	1/11¼	3/9	—
April ...	3/10	3/10½	2/6	2/3	2/1½	—	—	—
May	2/4½	2/11	—	—	—	—	4/10½	—
June... ...	1/6	1/1½	—	1/2	1/10	—	3/3¼	1/11
July	1/4	/10¾	2/	1/½	1/4	/10¾	2/9½	1/5
August ...	/11½	/11½	1/5	1/1½	1/	/11	2/3	1/4½
September ...	/10¾	/11½	1/4	1/1½	/8	/10½	2/1½	1/6½
October ...	/10¾	/11½	1/4½	1/4½	/8	/11	2/1½	1/9¾
November ...	—	/11½	1/4¼	1/4½	/8¾	/11	2/1½	1/9¾
December ...	—	—	1/4½	1/4½	/9½	1/½	2/1½	3/

§ 3. PESTS AND DISEASES OF THE VINE

Red Spider.—This is first seen by its causing small yellowish semi-transparent patches on the leaves, easily noticed by looking at the foliage against the light. If taken in time it can be stopped by sponging the patches with one of the spider killers advertised for the purpose. A moist atmosphere, a growing condition of the Vines, and the use of the Campbell's sulphur vaporizer are the best preventives. Most important of all is thorough attention to the cleaning of the house and rods in the dormant season. Red spider is caused by checks to the growth, dry borders, and general weakness through overcropping.

Warty Leaves are caused by sour borders or too moist an atmosphere. The sulphur vaporizer will kill the warts. Give a dressing of lime to the borders, and maintain a slightly drier atmosphere.

Vine Weevil.—Its presence is shown by green berries being found on the borders in places, and by the eating of the leaves. The weevils can be caught by tapping the Vines at night over a white sheet, and showing a bright light on the leaves at the same time. Green leaves put on the border will attract many during the night, and the weevils will be found under them in the morning. When the Vines are dormant, dress the borders with one of the tried soil sterilizers on the market at the strength advised by the makers. Before starting the house, grease-band the rods near the ground, putting the grease on grease-proof paper tied tightly round the rods; run a line of grease right round the plate and across the doors, and put some round every standard and plate tie, so that no weevil can get up to the leaves. See that no leaves touch the wall as they grow, and trap with leaves on the border. The writer has cleared the pest completely by these means.

Shanking is indicated by a black ring forming round the strigs of the berries or the stems of part, or the whole, of a bunch, and the berry or berries beyond shrivel and remain sour and uncoloured. Possibly caused by overcropping, sour borders, and unhealthy root conditions of some sort. Perhaps the best remedy is to prick up the soil with an old fork, and dress with basic slag or slaked lime and avoid heavy watering. Failing this the roots should be lifted, and the borders should be remade.

[W. M. B.]

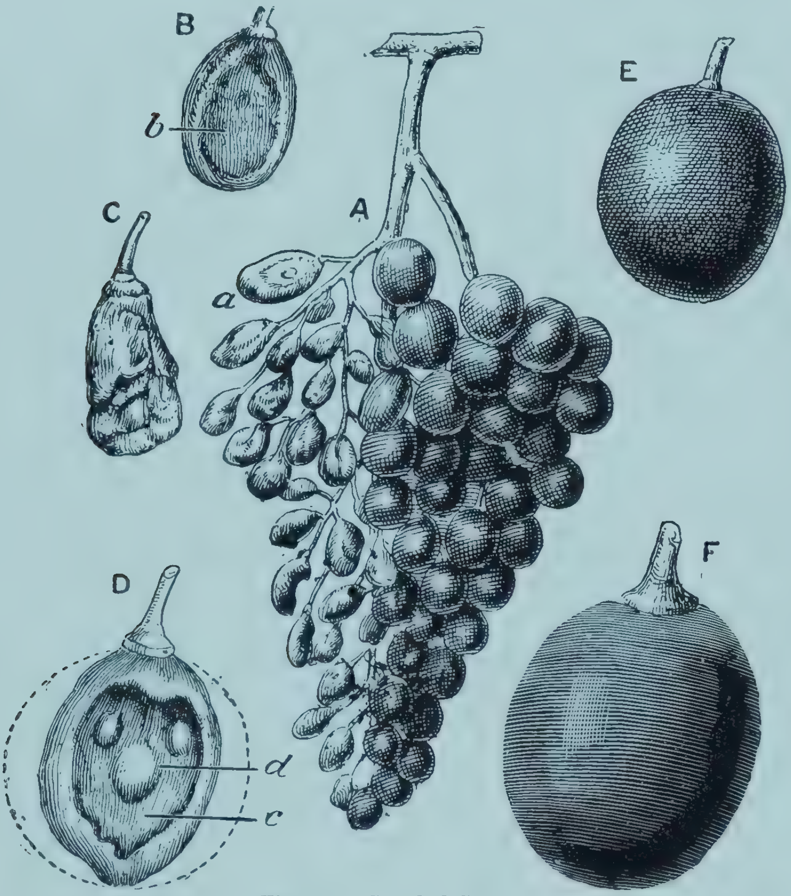


Fig. 390.—Scalded Grapes

A, Bunch of Lady Downes (reduced); *a*, scalded side.
B, Partly scalded berry; *b*, scalded portion.
C, Shrivelled berry, after scalding.
D, Partly scalded berry; *c*, shrunken patch; *d*, seeds.
E, Sound berry at time of scalding.
F, Perfectly finished berry.
All nat. size.

Scalding.—This is brought about by irregularities in the temperature, and causes the berries to assume a shrivelled or scalded appearance, as shown in the woodcut (fig. 390). The temperature should not be allowed to sink too low during the night, and the pipes should be kept warm enough for the purpose. In the morning, ventilation should be given when the sun is powerful, to keep the atmosphere in a buoyant state, and to prevent it from becoming too hot and stuffy. As scalding generally takes place during the stoning period, that is the time to take precautions against the evil. Some kinds, notably Lady Downes' Seedling, are more liable to attack than others.

Mealy Bugs (*Dactylopius citri* and *D. longispinus*).—Two Mealy Bugs attack the Vine. They can at once be told by *longispinus* having long lateral and tail processes, whilst *citri* has short ones. They live in any crevices on the Vines, and even amongst the fruit and under the skin of the rods and stems. They secrete a quantity of white wool at times, and their eggs are deposited under these woolly masses. Under glass they breed all the year round. The males are winged, and appear in the summer: they are reddish brown and mealy, with two iridescent blue wings and two long caudal filaments.

Mealy Bugs are best destroyed by fumigation with hydrocyanic acid gas as follows: On dormant Vines, for every 100 cub. ft., use ⅕ oz. of sodium cyanide, and for each ounce of cyanide 1 liquid oz. of sulphuric acid, previously diluted with 3 to 4 oz. of water; if potassium cyanide is used the proportion is ¼ oz. (See Vol. I., p. 169.)

Care must be taken in using this deadly gas. The cyanide must be dropped into the acid and water so that the operator does not inhale any of the deadly gas generated. This can be done by special apparatus sold by horticultural sundriesmen. The fumigation should last forty-five minutes, and is best done towards the latter part of the day, and the house freely ventilated from above before anyone is allowed to enter.

Painting with paraffin and methylated spirit is also useful for this pest.

Other Vine Pests.—The Grape-fruit Fly (*Drosophila melanogaster*), Vine Scale (*Pulvinaria vitis*), and the Phylloxera (*Phylloxera vastatrix*), which has now and again occurred in England. [F. V. T.]

Powdery Mildew of the Vine (*Uncinula spiralis*).—This very destructive disease was first noticed in a vinery at Margate in 1845, and within a very few years it had invaded Europe, Syria, Asia Minor, and Algeria, and, as usual on the first introduction of a new disease, caused very serious injury for some years. For many years the summer fruit of the fungus alone was known in Europe, and was called *Oidium Tuckeri*. Of late years, however, the winter fruit has also been found, sparingly. The latter is common on native plants in Japan and the United States. This is one of those parasites where the spawn or mycelium does not enter into the tissues of the plant, but forms a thin white film on the upper surface of the leaves, young shoots, flowers, and fruit. After a time these mildewed patches become densely covered with the white spores, and look as if they had been powdered with flour. This powdery appearance serves to distinguish the present from another white mildew attacking the Vine. When young leaves are attacked, growth

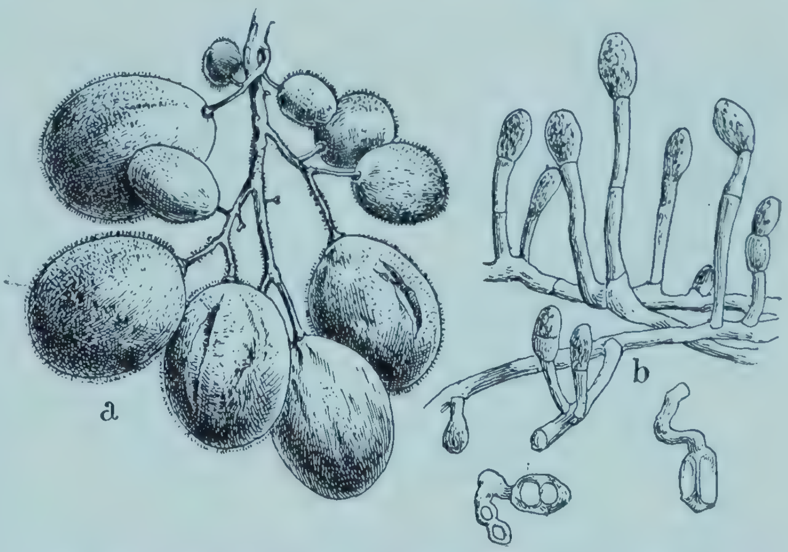


Fig. 391.—*a*, Mildew of Grapes, *Uncinula spiralis*. *b*, The summer form (*Oidium Tuckeri*) with conidia germinating (× 200)

is checked, and they usually soon die. In the case of old leaves, only the parts attacked by the fungus turn brown and die, the remainder usually undergoing no change. Young shoots that are attacked turn black and die, as does also the inflorescence. Berries soon crack and become distorted (fig. 391).

As the fungus is quite superficial, it can readily be reached by fungicides, and should cause but little trouble if promptly attacked. Spraying at intervals of three days with a solution of sulphide of potassium is the most certain remedy. Flowers of sulphur dredged or blown over the affected parts is also efficient, but it is more difficult to cover every part with a dry powder than with a substance in solution.

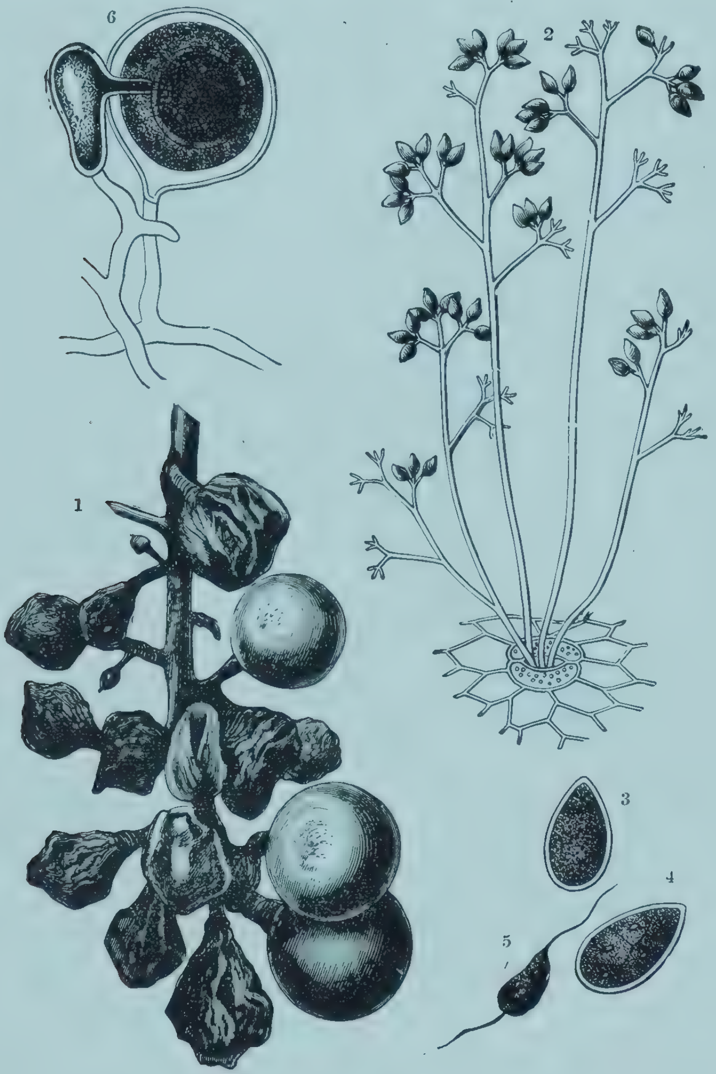


Fig. 392.—Vine Mildew (*Plasmopara* (*Peronospora*) *viticola*)

1, Summer form of fungus on grapes (natural size). 2, Summer fruit (magnified 80). 3, 4, 5, Detached spores of summer fruit (magnified 350). 6, Winter form of fruit formed on the mycelium of the fungus present in the tissues of the diseased portion of the plant (magnified 350).

The common practice of placing sulphur on the hot pipes is a practice that cannot be recommended. It is risky, and if the temperature exceeds a certain limit, scorching of the foliage is the result.

Grape Mildew (*Plasmopara viticola*).—This disease (fig. 392) is said to have been introduced into Europe from the United States, where it is very destructive both to cultivated and native wild vines. Every part of the plant is attacked, although the foliage suffers most, where its presence is first indicated by the appearance of sickly yellowish-green patches on the upper surface of the leaf, corresponding in position with patches of a very delicate greyish mildew on the under surface of the leaf. Under favourable weather conditions—that is dull, warm, and moist—the patches of mildew rapidly increase in size, and often cover the greater portion, or the whole, of the leaf. After this stage is reached, the leaf turns yellow, then brown, and falls. Tendrils and flowers are as promptly killed. Even if the berries are not attacked they do not mature properly, owing to the loss of the foliage, and the entire plant suffers through lack of food, which tells upon it the following season. Resting spores or winter fruit are formed in abundance in the tissues of all diseased parts of the vine. These, if not removed, germinate the following spring, and set up the infection again.

On the first indication of the disease, the Vines should be sprayed with half-strength Bordeaux mixture, the spraying being repeated at intervals as required, until the berries are set.

Black Rot or Anthracnose.—(*Guignardia Bidwellii*).—This disease is the scourge of American viticulturists, and has proved no less in Europe since its introduction along with American Vines, imported to replace those destroyed by the Phylloxera. The fungus forms various kinds of fruit, one of which was for a long time known as *Phoma uvicola*, a name which yet crops up in many works on gardening. The point is to remember that this name refers to the disease now said to be due to *Guignardia*. The general features of the disease are well marked, and cannot be mistaken. The leaves usually first show the disease under the form of irregularly circular spots, which often run into each other. These spots are sharply marked, and soon become brown and dead, and are then covered with minute black points, the Phoma fruit of the fungus. On the tips of the young shoots the spots are usually elongated, pale, and become more or less sunk below the general surface of the shoot. The berries usually suffer severely, the entire bunch becoming shrivelled and mummified, and covered with minute black warts representing the Guignardia fruit of the fungus. These shrivelled berries do not fall, but hang on the vine for a considerable time, unless removed, as they should be, along with diseased shoots.

Dr. C. L. Shear, an American plant pathologist, has paid especial attention to this disease, and has found that by spraying with half-strength Bordeaux mixture, commencing when the shoots are 8 in. to 1 ft. in length, the disease can be held in check. Five or six sprayings, at intervals, are generally necessary. If the disease is not checked before the fruit is approaching maturity, then neutral copper acetate, 1 lb. to 50 gall. of water, should be used, as it does not stain the fruit, whereas Bordeaux mixture does at this stage.

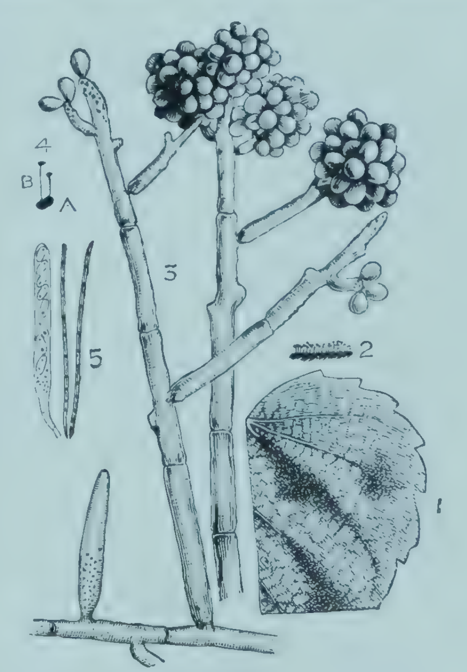


Fig. 393.—Brown Vine Mildew (*Sclerotinia fuckeliana*)

1, Summer fruit on portion of a vine leaf (reduced in size). 2, Summer fruit (natural size). 3, Portion of summer fruit (magnified 300). 4, Winter fruit springing from a small black sclerotium (natural size). 5, Mode of spore formation in winter fruit (magnified 200). (*Journal Royal Horticultural Society.*)

Brown Mildew of the Vine (*Sclerotinia fuckeliana*).—Too frequently in neglected vineries the leaves and bunches of berries are more or less covered with a dense brown or mouse-coloured mould, often called *Botrytis* *cinerea.* This is one of the commonest of moulds we have in this country, and may be met with on decaying vegetable matter everywhere. It can only become a parasite in the presence of an excess of moisture and in a stuffy atmosphere. Its presence on Vines can only be attributed to gross neglect in ventilating, more especially early in the day. When the fungus once gains a foothold it is difficult to exterminate promptly, as spores are produced in rapid succession and in immense numbers, and are dispersed by wind, watering, &c. A fairly dry atmosphere is fatal to the fungus, and aided by spraying with sulphide of potassium will restore things to order (fig. 393).

Crown Gall.—This disease is very prevalent on Vine roots. Described under "Loganberry" (see p. 163). [G. M.]

SECTION XXVI

Nuts

HAZEL NUTS

§ 1. GENERAL

The hard-shelled fruits variously known as Hazel Nuts, Filberts, and Cob Nuts are produced by a somewhat hairy or downy shrub or small tree (*Corylus Avellana*), the wild form of which is a native of Great Britain and Ireland, but is also found throughout Europe, North Africa, and temperate Asia. The leaves are roundish heart-shaped, pointed, deeply and distinctly veined, and doubly toothed on the margins. The male and female flowers are borne on the one-year-old shoots, but are quite distinct from each other. The male flowers are borne in conspicuous drooping pale-yellow catkins, 1 to 2 in. long, from January to March. The female flowers are comparatively inconspicuous, but are much more important from the nut grower's point of view. They are borne on the same shoots as the male catkins, but in fat stalkless buds above them. About February and March these buds (which are plumper than the ordinary wood buds) begin to break, and several bright crimson thread-like styles protrude, as shown in the drawing (fig. 394). They are then ready to be fertilized, and some of the pollen from the male catkins, being blown about by the wind, is sure to come in contact with the tips or stigmas of the crimson styles. In due course the young nuts begin to swell, and ultimately form the "nut" enclosed in the leathery husks. It is essential for the grower to bear this little piece of natural history in mind, especially at pruning time. If the young shoots containing the catkins and female flowers are cut away, it means no fruit.

The Cob or Filbert may be looked upon almost as a crop peculiar to Kent. It may, however, be, and is, grown in other parts of the kingdom, and gives a fair return as a market-garden crop in suitable situations.

A sandy loam, seated on a chalky or limestone subsoil, is considered the most suitable soil for nuts. It should be prepared by subsoil ploughing and harrowing some time before the planting period, so as to have it in a clean condition. If the soil is too rich, there is a danger of too much wood being produced at the expense of fruit. A soil of this description, however, might be rectified by an annual dressing of lime (20 to 40 bus. to the acre) or by the application of 5 to 10 cwt. of basic slag early in January. On land where rampant growth is observable, it would be well not to apply stable or farmyard manure for a few years.

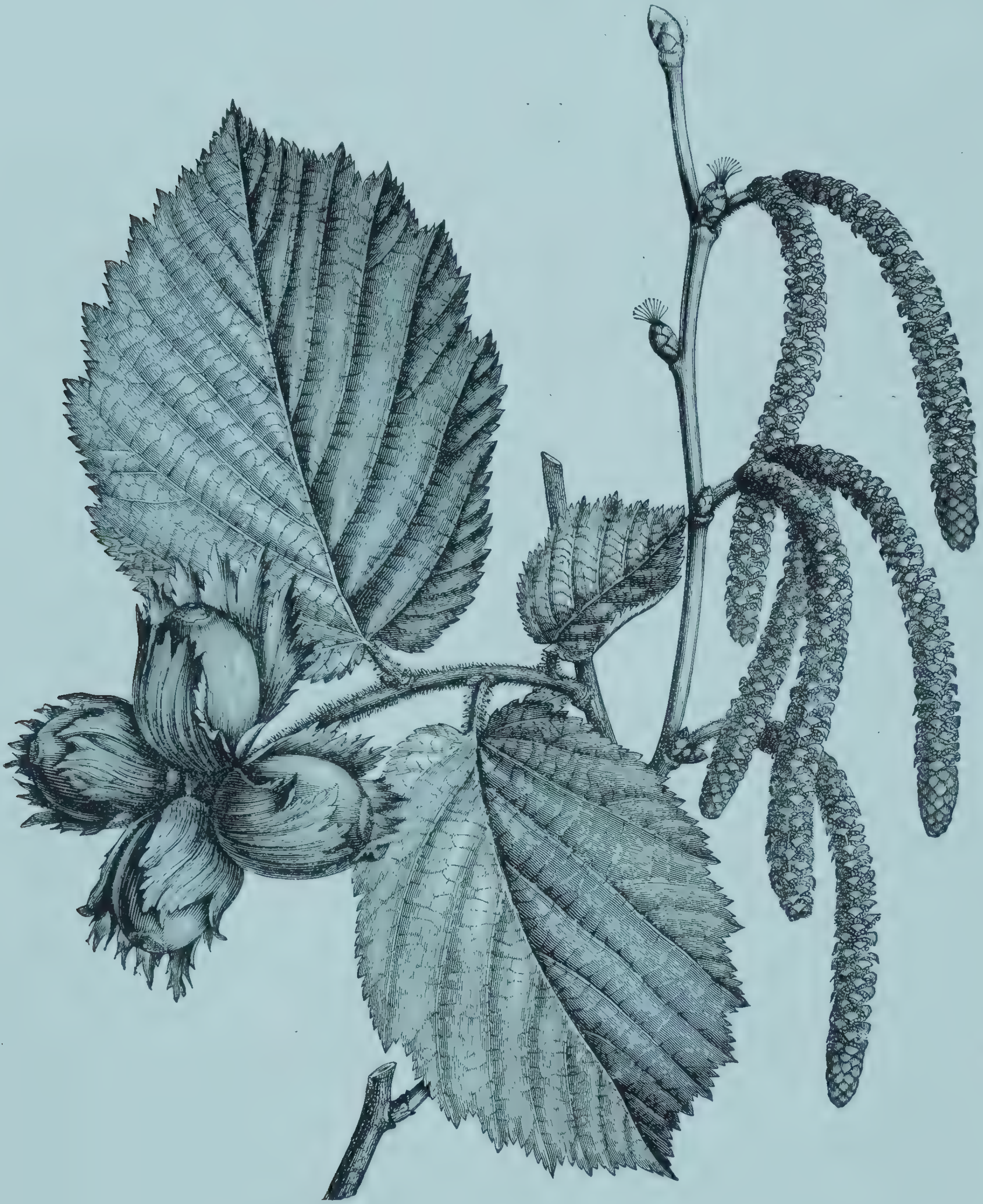


Fig. 394.—The Hazel (*Corylus Avellana*), showing male drooping catkins, female flowers, and nuts

Nut trees are usually grown on a stem $1\frac{1}{2}$ to 2 ft. high, from which the branches are trained outwards so as to form a kind of skeleton vase. In this way the leaves and shoots are exposed fully to the ripening influence of air and light. The planting should be done in October or November, and young bushes will cost about 30*s.* per 100. They are often planted 10 ft. apart each way, but better results are likely to be obtained at 12 ft. apart each way, giving about 300 trees to the acre. The intervening space may be cropped with Gooseberries, Currants (about 750 to the acre), or Raspberries, or vegetable crops until the nut trees require all the ground to themselves. No returns can be expected for the first five or six years from the nuts, but once in bearing the 300 trees ought to yield an average crop of 10 to 12 cwt., that is, about 3½ to 4 lb. of nuts to each plant. At 6*d.* per pound the gross returns would vary from £28 to £33 per acre. The diagram, representing roughly ¼ ac., shows how nuts and bush fruit like Gooseberries or Currants should be planted.

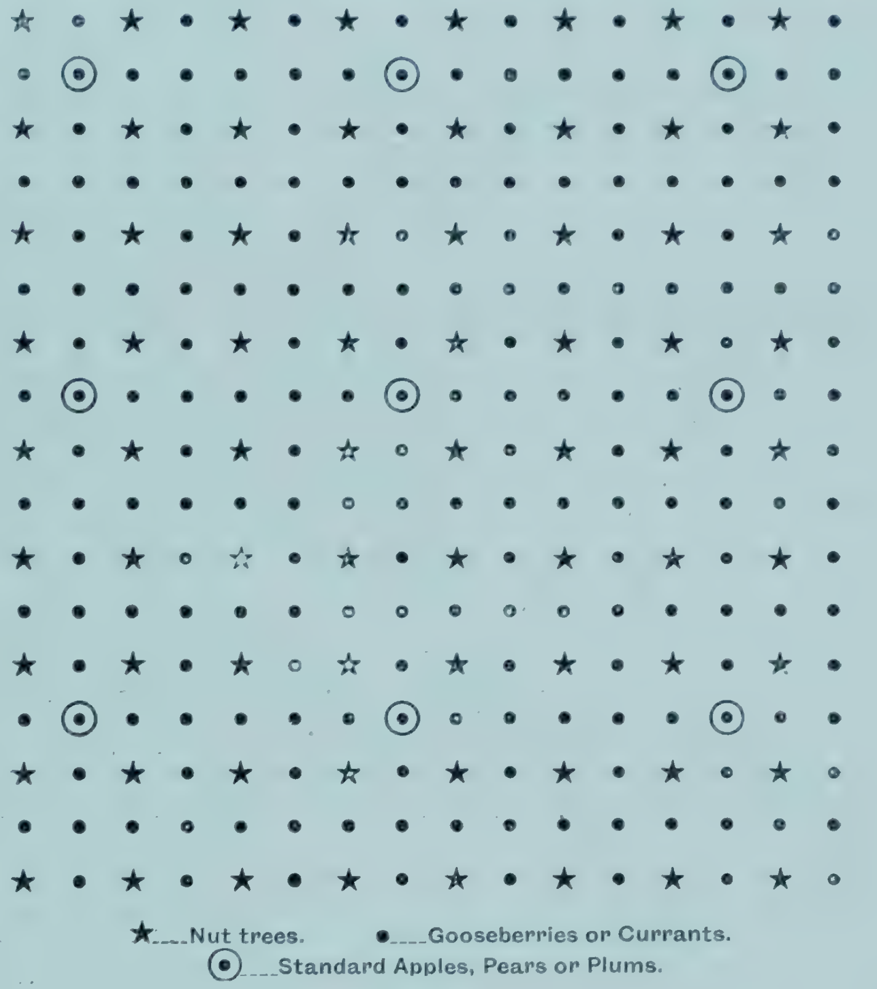

★----Nut trees.
●----Gooseberries or Currants.
⊙----Standard Apples, Pears or Plums.

Fig. 395

If standard Apples, Pears, or Plums are planted at 36 ft. apart, about thirty-three will be required to the acre, and these will come into bearing in due course without interfering with the nut trees. When the Apples, Pears, or Plums are established, the returns from them would be anything from £10 to £20 per acre, according to the crop and the prices prevailing. The annual cost of cultivation might be reckoned about £15, and after allowing for rent, rates, taxes, marketing, &c., the net profit would vary from £10 to £20 per acre.

Pruning.—This is an important operation, and should only be performed by experienced gardeners. A good strong pruning knife should be used, or if it is necessary to use a saw for thick wood, it will always pay to trim the rough surface afterwards with the knife, otherwise the shoot is apt to die back. As the nuts are borne on the young wood, as shown in the illustration, the best of this should be retained, and only the weak shoots cut out. The centre of the tree should always be kept open and clear of shoots and twigs. As the plants are rarely allowed to grow more than 6 or 8 ft. high, it will be necessary to shorten back some of the strong leading shoots in winter, always cutting to a bud pointing away from the centre. In this way new young wood will develop lower down the main branches, and will in due course bear fruit. After this, such shoots, being no longer useful for fruiting purposes, may be cut back to a couple of buds at the base, so as to give rise to fresh shoots, which will eventually be subjected to the same process.

The best kind of nut for market purposes is "Kentish Cob" or "Lambert Filbert". It grows vigorously, and bears large thick-shelled nuts in clusters of three or four, sometimes more, sometimes less, according to the season. There are over twenty other kinds of nuts, of which, perhaps, Webb's Prize Cob Filbert is the best for trade purposes.

§ 2. NUT PESTS

The Nut Weevil (*Balaninus nucum*).—Cob, filbert, and wild hazels are often badly damaged by a maggot or grub which eats out the kernel. This is the larva of the Nut Weevil (*Balaninus nucum*). This weevil can readily be distinguished by its long curved proboscis. In length it is about $\frac{1}{3}$ in., the colour tawny brown, densely clothed with golden-brown pubescence. The beetles lay their eggs in the small and tender nuts, first piercing them with their proboscis. The egg hatches in eight or ten days. The maggot, which feeds on the kernel, is white, footless, and fleshy, fat and curved, with brown head: length rather more than $\frac{1}{3}$ in. When mature the maggot eats its way out of the nut and leaves behind a small round hole in the shell. The winter is passed in the pupal stage in a cocoon of earth in the soil.

TREATMENT.—This pest may be checked by spraying in May with arsenate of lead. Winter cultivation of the soil beneath the bushes destroys a good many.

Other Nut Pests.—The Winter Moth (*Cheimatobia brumata*), Mottled Umber Moth (*Hybernia defoliaria*), Buff Tip Moth (*Phalera bucephala*), Nut-leaf Blister Moth (*Lithocolletis coryli*), Leaf Weevils (*Phyllobius sp.*), the Nut-leaf Weevil (*Strophosomus coryli*), Nut Sawfly (*Crœsus septentrionalis*), Catkin Midge (*Cecidomyia coryli*), Nut Aphis (*Siphonophora avellanæ*), Nut-bud Mite (*Eriophyes avellanæ*). [F. V. T.]

THE WALNUT

§ 1. GENERAL

Walnut.—Apart from its value as a timber and ornamental tree, the Walnut (*Juglans regia*) is also a valuable fruit tree. It is not, however, grown as a crop in the same sense that other fruit trees are, but is usually found dotted about here and there in open places in market gardens and large pleasure grounds. In a wild state the Walnut is found from south

Europe eastwards to the Himalayas, Persia, and Upper Burma, and in some of these countries is said to attain an age of 300 to 400 years. In favoured parts of Britain it attains a height of over 60 ft., and a diameter of 2 to 4 ft. It has a whitish-grey bark, and leaves divided into from five to thirteen smooth lance-shaped leaflets, which in a young or seedling stage are serrate on the margins. The male flowers are borne in drooping catkins 2–5 in. long, on the previous year's wood, and the female blossoms are borne at the tips of the same shoots in clusters varying in number, but usually two or three, as shown in the sketch (fig. 396). Several fine examples are to be met with in the older market gardens of Middlesex, and also in parts of Bucks and Hants. On well-established trees the crop of nuts will vary from 6 or 7 bus. to as many as 60, according to the season and soil. A bushel of walnuts with the husks on will yield about $\frac{1}{2}$ bus. of nuts; and 1 bus. will weigh about 40 lb. and contain about 1000 nuts. A fair average price is about 6*s.* a bushel, but this price is improved upon when the nuts are retailed at ten a penny. English walnuts always fetch higher prices than foreign ones, of which about 70,000 bus. are imported annually. The nuts are gathered in a ripe and unripe stage. In the latter case they are picked about the first or second week of July, while the skins are still tender, and in this state the green young fruits are largely used for pickling. When ripe, in autumn, the

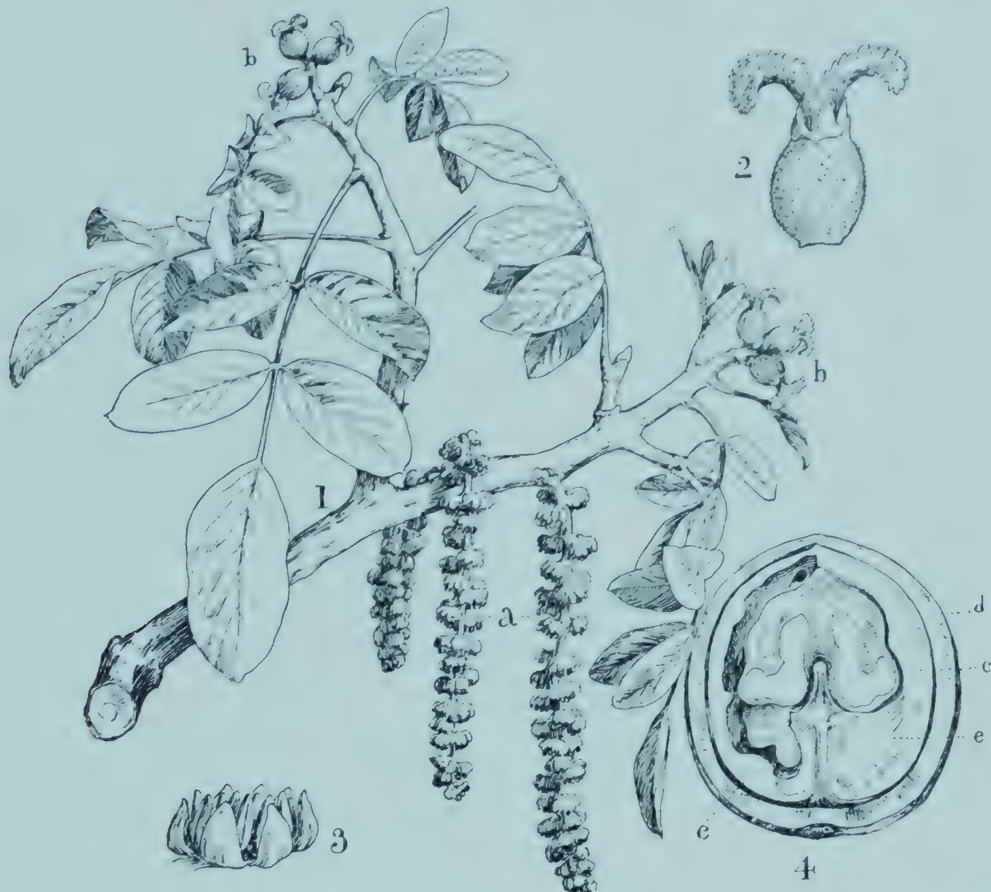


Fig. 396.—1, Shoot of Walnut; *a*, male flowers, *b*, *b*, female flowers. 2, Female flower. 3, Male flower. 4, Section of Walnut; *c*, seed, *d*, green husk, *e*, *e*, shell.

nuts are usually beaten from the trees with long supple ash rods, and there is an impression that this is the best possible way, and that the trees themselves are benefited by the thrashing. Indeed there is an old saying to the effect that—

> "A woman, a dog, and a Walnut tree,
> The more you thrash them, the better they be".

The husks, if placed in tubs, with a little salt added, and pressed under heavy weights, make an excellent ketchup, the juice being strained off and used neat or diluted with some pure boiled vinegar.

The Walnut flourishes in a rich sandy loam, and may be raised from seeds which are sown as soon as ripe, or in spring, after being stratified in sand during the winter to preserve the vitality. Besides the Common Walnut the following are also met with: *Highflyer*, early, thin-shelled: *Large Double*, with very large double fruits; *Thin Shelled*, double, early, with a very thin shell, and fine flavour.

§ 2. DISEASES

Walnut-leaf Blotch (*Gnomonia leptostyla*).—Small brown patches sometimes appear on the living leaves. As a rule these are few in number, and practically do no harm. Now and again, however, these patches are crowded on the leaves, which in consequence turn yellow, and fall quite early in the season. This, of course, materially affects the crop, not only for the present, but also for the following season. If the trees are not too large, spraying with Bordeaux mixture, when the disease is first observed, checks its spread.

The fungus perfects its fruit on the dead, fallen leaves during the winter, and it is only by means of the spores produced in these fruits that the young leaves can be infected the following season; hence it is advisable to have all such leaves removed when they fall. This may appear to be impracticable advice, yet it is just as well that the facts should be known, whether the advice is followed or not.

Walnut-leaf Spot (*Ascochyta juglandis*).—This fungus forms greyish blotches up to ¼ in. across on living Walnut leaves. These patches become dead and dry and fall away, leaving holes in the leaf. As a rule but few patches are present on a leaf, and the injury is slight, but every now and again there is an epidemic, when the leaves fall early in the season, which means badly matured and dwarfed shoots. The remedies suggested for the previous disease are applicable in the present instance, only the fallen leaves need not be troubled about, as the fungus has been carried away on the dead pieces of leaf that dropped out before the leaves fell.

[G. M.]

SECTION XXVII

Melons

The Melon (*Cucumis Melo*), although never found in a wild state, seems to have been cultivated for centuries in Asia Minor, Persia, Afghanistan, &c., and for many generations has been a favourite fruit in British gardens. It is an annual like the Cucumber, and is also monœcious; that is, it bears male and female flowers on the same plant, quite distinct from each other. The leaves are somewhat thicker, and of a greyer green than those of the Cucumber, and the fruits vary in shape from round to elliptic, flattish, and elongated, according to the different sections or varieties, of which there are many.

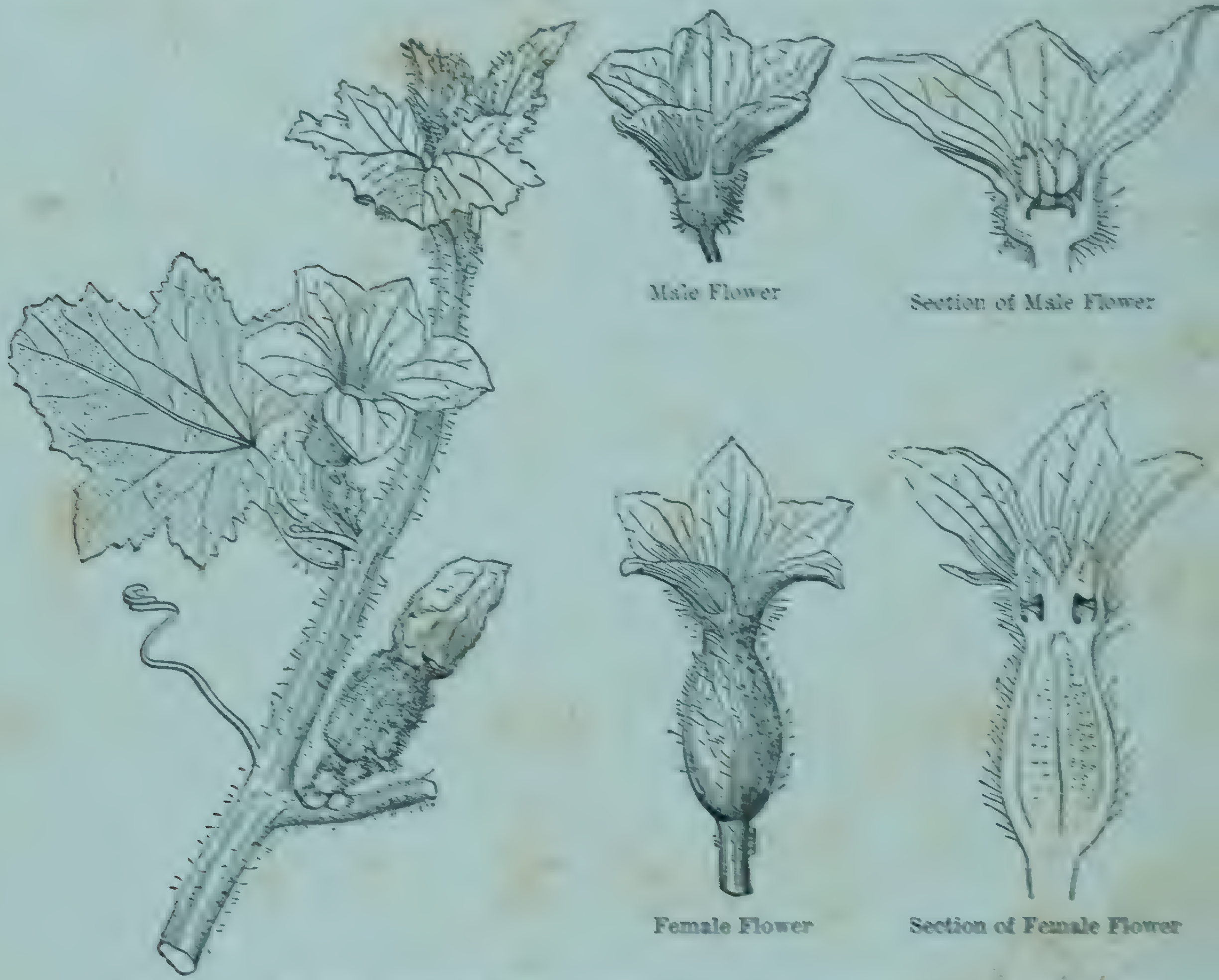
Of late years Melon growing for market has become a big business, and in Guernsey especially large quantities of fruit are ripened each year for the English markets. The methods of culture differ somewhat from that practised in private establishments, in some of which there is almost as much importance attached to producing a new Melon as to the discovery of the North Pole.

Market growers in the Channel Islands and England prefer the roundish netted varieties with green, scarlet, or white flesh, while French cultivators prefer the Canteloupe varieties.

Melons for market are grown in small span-roofed houses in the same way as Cucumbers in many places, being planted out in beds or borders of rich soil. In Guernsey, growers have large houses about 200 ft. long, 40 ft. wide, and 15 to 20 ft. high, strongly built, and the Melons are grown in large pots, the stems being trained vertically up string, or tied to long bamboo stakes. As a rule two crops of fruit can be produced easily in one year, between February and the end of August, but some of the Guernsey growers try a third crop after this, having raised the plants, of course, in good time.

Sowing.—It is best to sow melon seed singly in 3-in. pots, about an inch below the surface, in rich loam with a little well-rotted manure or leaf soil, and a little sand. The first sowing is made about the first week in February, and in a temperature of 75° to 85° F. the young plants are well through the soil in less than a week. The atmosphere should be humid yet buoyant, and the young plants must be carefully attended to to bring them on rapidly. At the end of two or three weeks from the date of sowing the seed the young plants will be large enough to transfer to their fruiting quarters, whether in pots or in specially prepared borders.

The soil to be used then should consist principally of well-matured turfy loam, with which a fair supply of well-decayed manure may be well mixed. A little basic slag, owing to the fact that it contains lime and phosphates and is slow in its action, may also be incorporated with advantage—about 2 lb. of basic slag to 1 ton of soil being sufficient. Where beds are made up, they should be about 18 in. thick, and 1–2 ft. wide. The plants should be turned out of the pots carefully, and inserted in holes about 12 in. apart, taking care to have the collar of the plants not too deeply buried. The soil should be made firm round each plant, so that it shall not afterwards sink too much and perhaps snap the plant at the base from the wires or strings to which the stems are tied. When grown in pots too much soil is not given at first, space being left for additions and topdressings as growth proceeds. Even when grown in beds, the roots begin to show through the surface in the same way as those of Cucumbers, and topdressings of rich loam and well-rotted manure are essential from time to time.



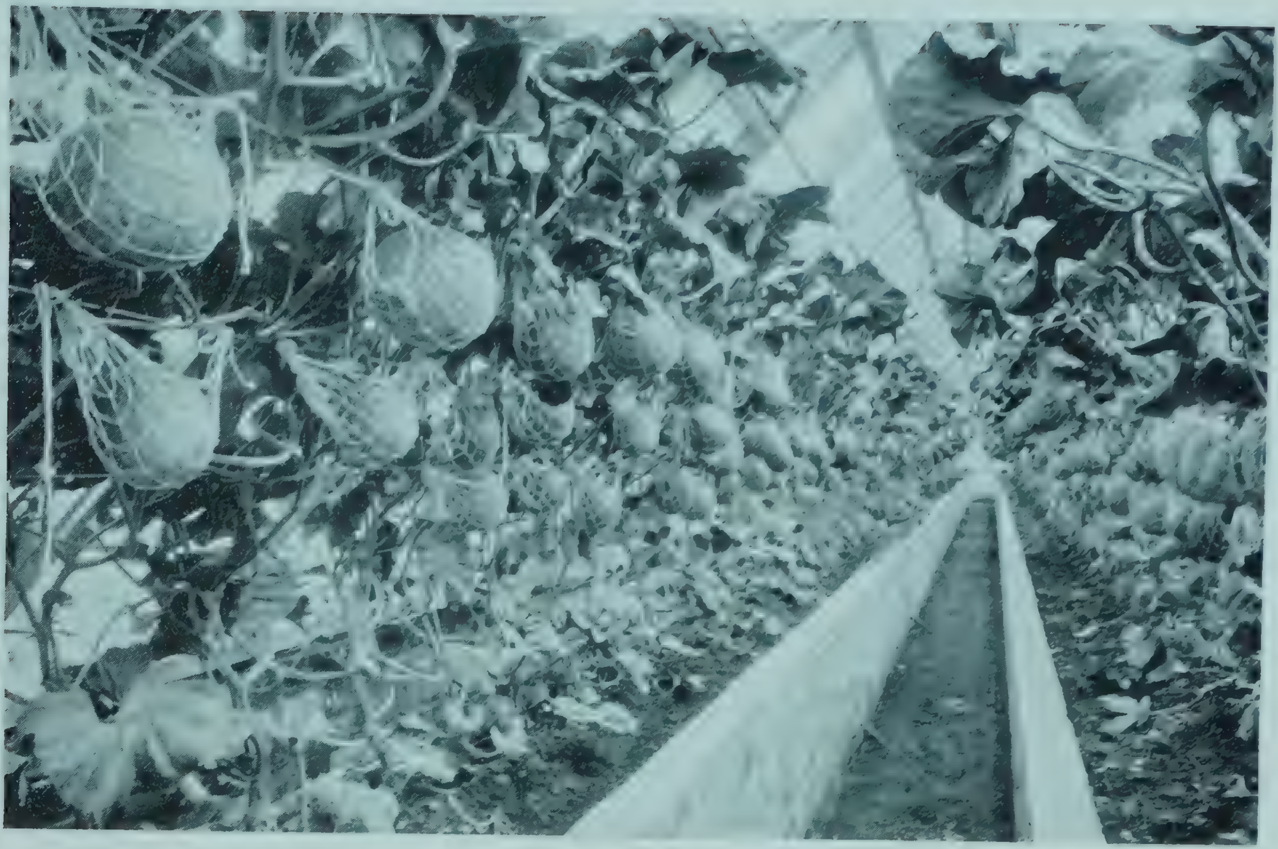
Male Flower

Section of Male Flower

Female Flower

Section of Female Flower

Fig. 397.—Male and Female Flowers of the Melon (*Cucumis Melo*)



MELONS GROWN FOR MARKET

At Messrs. Ambrose & Palmer's, Shepperton, Middlesex

GRAPES AND STRAWBERRIES AS PACKED FOR RETAIL SALE IN BELGIUM

As growth proceeds, and the main stem lengthens, the side shoots are suppressed, to concentrate the vigour of the plant. It is important to do this before the side shoots attain any length, most growers pinching them out before they are ½ in. long. The flowers appear in due course, and the grower decides after a time whether he will have one, two, three, or more fruits on a plant. In Guernsey, the rule seems to be one fruit to one plant, as with the Canteloupe Melons grown in intensive gardens, but English growers usually allow two fruits to mature, all others being suppressed.

The female blossoms are fertilized by hand with pollen from the male flowers, but in the early stages, until the plants are well established and sturdy, all flowers are removed. The illustration (fig. 397) shows the difference in structure between the male and the female flowers, and how they are borne in the axils of the leaves.

During growth attention must be given to watering and syringing, and the air must be kept in a buoyant condition by proper ventilation. Cold draughts must be avoided, and the night temperature should not fall below 70° F. for the first crop, and about 75° F. for the second crop in summer.

The plants should be syringed in the mornings and afternoons with water having the same temperature as the house, and this operation may be continued until the fruits are well developed. When nearing maturity, however, the syringings must be discontinued, and more air may be given. Ripe melons will weigh from 8 lb. to 15 lb. each, and realize from 2s. to 4s. in the market. If seeds are sown the first week in February it will be possible to cut the first fruits by the first week in May—about three months from the date of the sowing, and the whole crop should be finished by the second or third week in June. A second sowing of seed may be made the second or third week of June, and fruit will be ready for cutting seven or eight weeks later, the whole crop being finished by the end of August.

Varieties.—As to varieties, there are many, having green, white, or scarlet flesh. In Guernsey the kind largely grown is the "Guernsey A1", but almost any good standard kind will do for market. Some good melons are:—

White-fleshed: Best of All, Royal Sovereign, Sutton's Universal, Golden Orange, Hero of Lockinge, The Countess.

Green-fleshed: Golden Perfection, Royal Jubilee, The Grosvenor, William Tillery, Windsor Castle, Ringleader, British Queen, Earl's Favourite.

Scarlet-fleshed: Blenheim Orange, Sutton's Empress, Monro's Little Heath, Reid's Scarlet, Sutton's A1 (improved), Sutton's Superlative, Triumph, Invincible, Frogmore Orange.

Pests.—Melons are most liable to attacks of Red Spider, but if the atmosphere is kept fairly moist and buoyant there is little to fear from this pest. The houses in which Melons are grown should be thoroughly cleansed now and again by limewashing the walls and woodwork. In the event of Greenfly appearing the plants should be syringed with nicotine, soft soap, and quassia solutions, or the houses may be vaporized with Richard's XL All.

The Melon-leaf Blotch may appear if the houses are kept too hot and too moist, and badly ventilated, but not otherwise, unless infection is secured from a previously diseased crop. The disease is caused by a fungus called *Cercospora Melonis.* It soon spreads in patches all over the leaves when the plants are grown under unhealthy conditions. When first noticed, afflicted leaves should be picked off and burned at once. More air should also be given by regulating the ventilators, but the proper temperature must be maintained. Too much water should be avoided, and the healthy foliage may be sprayed with a solution of sulphide of potassium (liver of sulphur), at the rate of 2 oz. to 3 gall. of water, as a preventive. An ounce or two of camphor placed in a muslin bag, and sunk in the water-tanks, has also been found a good preventive. The important point, however, is to secure proper growing conditions and a buoyant atmosphere.

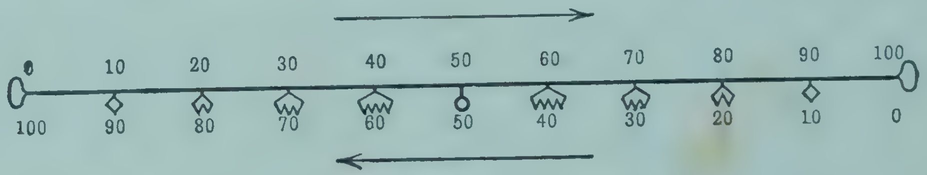
SECTION XXVIII

Garden Surveying, Levelling, and Mensuration

MEASURING OF LAND

Everyone connected with the land, be he market gardener, nurseryman, or farmer, should make himself acquainted with the principles of land surveying and measuring in so far as they relate to his business. A knowledge of the art will not only be useful in itself but will prevent anyone from making serious miscalculations as to areas, and the quantities of produce to be obtained from them. Such ground operations as levelling, digging, trenching, draining, &c., can be measured up to a nicety, and the cost of the work estimated very closely in advance. In the case of wet or heavy land, a knowledge of surveying and levelling will enable the market gardener or farmer to decide without any possibility of mistake the lowest part of his land, towards which it may be advisable to run drains or to dig trenches or ditches for drainage purposes. If walls, fences, greenhouses, or buildings of any description are to be erected, it is advisable to go over the land--survey it—to discover the most suitable sites or levels for the intended operations. Mensuration is so closely bound up with surveying operations that a knowledge of it is indispensable, and will be found of great advantage. Thus, if it is desired to heat a glass structure that is intended for the cultivation of stove or greenhouse plants, a certain quantity of hot-water piping will be necessary to supply sufficient heat, according to the cubic capacity of the greenhouse. The cubic contents of any glasshouse or other building are easily arrived at by mensuration, and this knowledge enables one to know almost exactly the quantity of piping necessary for any particular house. In the same way the area or contents of any building or structure, pipes, boilers, tanks, water pots, flower pots, &c., may be found. And if repairs are necessary it will be easy to estimate the quantities of paint, putty, bricks, timber, &c., required.

In that branch of horticulture known as "landscape gardening", a good knowledge of land surveying and levelling, and mensuration, is almost essential; otherwise the "landscape artist" will have to employ the services of a professional surveyor whose knowledge of horticultural matters may be *nil*. The landscape gardener has often to deal with the laying out of large or small areas of land and water, and he may have to convert a level meadow into an undulating garden with lakes and ponds arranged for landscape effect. Work of this description entails a good deal of labour and expense, and if a man has no knowledge of surveying or mensuration he may very easily underestimate or overestimate the cost of transforming a piece of land from one state into another.



Surveying chain showing brass markers in position

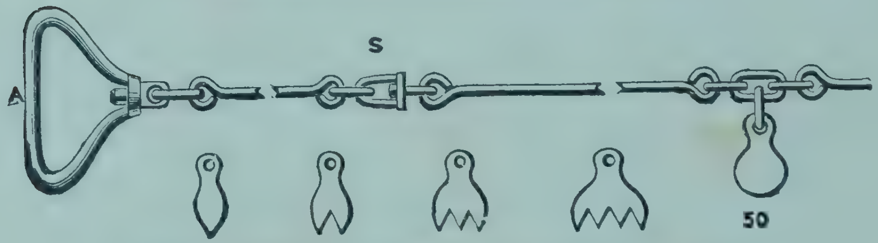


Fig. 398.—Details of Surveying Chain. A, Handle; S, Swivel

Land Measure.—In measuring land a chain called "Gunter's chain" (fig. 398) is used. It consists of 100 links, each of which is 7·92 in. long. The whole chain is thus $\frac{792}{12}$ = 66 ft. long = 22 yd. = 4 lineal poles or rods. A rod, pole, or perch is 5½ yd. = 16½ ft. And 1 ac. = 4 roods = 160 sq. rods, poles, or perches = 4840 sq. yd. = 43,560 sq. ft. One square mile = 5280 × 5280 sq. ft. = 640 ac. Again, 5280 ft. = 1760 yd. = 8 fur. = 1 m. = 80 chains. And 1 ac. = 10 sq. chains = 100,000 sq. links. One square pole or perch = 625 sq. links. Square links are easily reduced to acres by dividing by 100,000, or, in other words, marking off five figures from the right, and the result is the equivalent in acres and decimals of an acre. Thus, if the area be 387,564 links, by dividing by 100,000 we obtain 3·87564 ac. By multiplying the decimal figures by 4, and marking off, the roods will be found; and by multiplying the decimal figures in the roods by 40, the number of perches, poles, or rods will be found, and so on with the yards and feet. Thus 387,564 sq. links = 3 ac., 3 roods, 20 sq. poles, 30 sq. yd. 8 sq. ft.

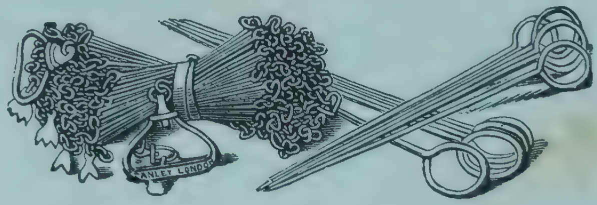


Fig. 399.—Surveying Chains and Arrows

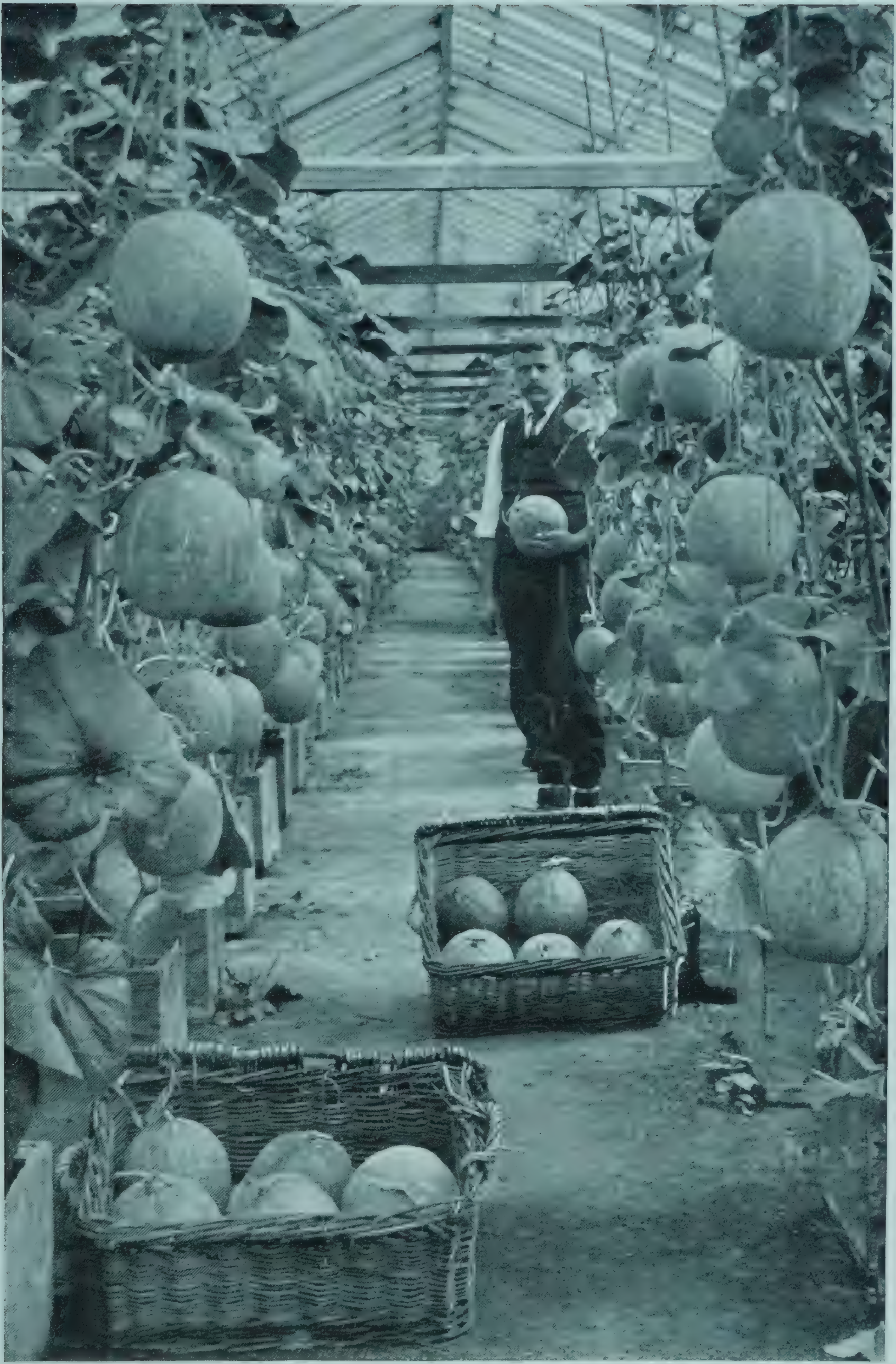


Photo. E. J. Geary

MELONS GROWN FOR MARKET

At Mr. E. Rochford's Nursery

TABLE SHOWING NUMBER OF LINKS IN FROM 1 TO 100 FT.

Feet.		Links.	Feet.		Links.	Feet.		Links.
1	=	1·52	12	=	18·2	55	=	83·3
2	=	3·0	13	=	19·7	60	=	90·9
3	=	4·5	14	=	21·2	65	=	98·5
4	=	6·1	15	=	22·7	70	=	106·1
5	=	7·6	20	=	30·3	75	=	113·6
6	=	9·1	25	=	37·9	80	=	121·2
7	=	10·6	30	=	45·4	85	=	128·8
8	=	12·1	35	=	53·0	90	=	136·4
9	=	13·6	40	=	60·6	95	=	143·9
10	=	15·2	45	=	68·2	100	=	151·5
11	=	16·7	50	=	75·8			

TABLE SHOWING THE NUMBER OF YARDS, FEET, AND INCHES IN FROM 1 TO 100 OF THE LINKS OF THE IMPERIAL CHAIN

Links.	Yd.	Ft.	In.	Links.	Yd.	Ft.	In.	Links.	Yd.	Ft.	In.	Links.	Yd.	Ft.	In.
1	0	0	7·92	26	5	2	1·92	51	11	0	7·92	76	16	2	1·92
2	0	1	3·84	27	5	2	9·84	52	11	1	3·84	77	16	2	9·84
3	0	1	11·76	28	6	0	5·76	53	11	1	11·76	78	17	0	5·76
4	0	2	7·68	29	6	1	1·68	54	11	2	7·68	79	17	1	1·68
5	1	0	3·6	30	6	1	9·6	55	12	0	3·06	80	17	1	9·6
6	1	0	11·52	31	6	2	5·52	56	12	0	11·52	81	17	2	5·52
7	1	1	7·44	32	7	0	1·44	57	12	1	7·44	82	18	0	1·44
8	1	2	3·36	33	7	0	9·36	58	12	2	3·36	83	18	0	9·36
9	1	2	11·28	34	7	1	5·28	59	12	2	11·28	84	18	1	5·28
10	2	0	7·2	35	7	2	1·2	60	13	0	7·2	85	18	2	1·2
11	2	1	3·12	36	7	2	9·12	61	13	1	3·12	86	18	2	9·12
12	2	1	11·04	37	8	0	5·04	62	13	1	11·04	87	19	0	5·04
13	2	2	6·96	38	8	1	0·96	63	13	2	6·96	88	19	1	0·96
14	3	0	2·88	39	8	1	8·88	64	14	0	2·88	89	19	1	8·88
15	3	0	10·8	40	8	2	4·8	65	14	0	10·8	90	19	2	4·8
16	3	1	6·72	41	9	0	0·72	66	14	1	6·72	91	20	0	0·72
17	3	2	2·64	42	9	0	8·64	67	14	2	2·64	92	20	0	8·64
18	3	2	10·56	43	9	1	4·56	68	14	2	10·56	93	20	1	4·56
19	4	0	6·48	44	9	2	0·48	69	15	0	6·48	94	20	2	0·48
20	4	1	2·4	45	9	2	8·4	70	15	1	2·4	95	20	2	8·4
21	4	1	10·32	46	10	0	4·32	71	15	1	10·32	96	21	0	4·32
22	4	2	6·24	47	10	1	0·24	72	15	2	6·24	97	21	1	0·24
23	5	0	2·16	48	10	1	8·16	73	16	0	2·16	98	21	1	8·16
24	5	0	10·08	49	10	2	4·08	74	16	0	10·08	99	21	2	4·08
25	5	1	6·	50	11	0	0·	75	16	0	16·	100	22	0	0·

Chaining.—Surveying chains are made of steel or iron wire. At every 10 links from each end of the chain a piece of brass known as a teller or marker is attached, as shown in the figures. These markers are notched to indicate the number of links in tens from each end up to the fiftieth link or middle of the chain. Thus a reference to the figure shows that the first marker indicates 10 links from one end or 90 links from the other; a marker with two points indicates 20 links from one end and 80 links from the other; three points, 30 links from one end, and 70 links from the other; four points, 40 links from one and 60 links from the other; while the fiftieth or middle link has a circular marker attached. By means of these markers any distance is easily reckoned.

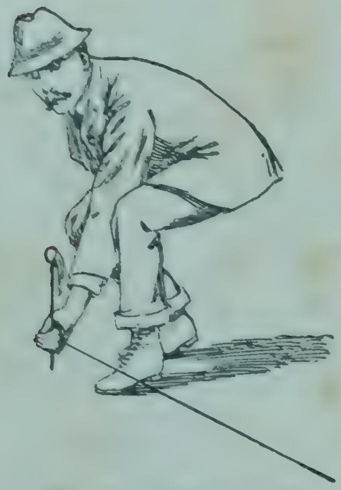


Fig. 400.—Chain Leader

In using a chain, two operators are required—one to lead and one to follow. The follower holds the chain by means of the ring at end fairly against the post from which a start is to be made. The leader (fig. 400) takes the other end of the chain and walks in a straight line towards a definite point, indicated by a staff. He carries ten arrows, one of which he places at the end of each chain that is measured (see fig. 399). The follower then moves forward and holds his end of the chain against the arrow left by the leader. The latter proceeds to the length of the chain and fixes the second arrow in the ground. The follower then takes up arrow No. 1, and holds the end of the chain at the point where the leader has fixed arrow No. 2, and so on to the finish. If less than ten chains are measured, the number of arrows left in the leader's hands will show how much has been unchained, the arrows in the follower's hand, of course, representing the distance covered. Any distance less than a chain is measured in links, and the brass markers on the chain indicate the number of links as above stated.

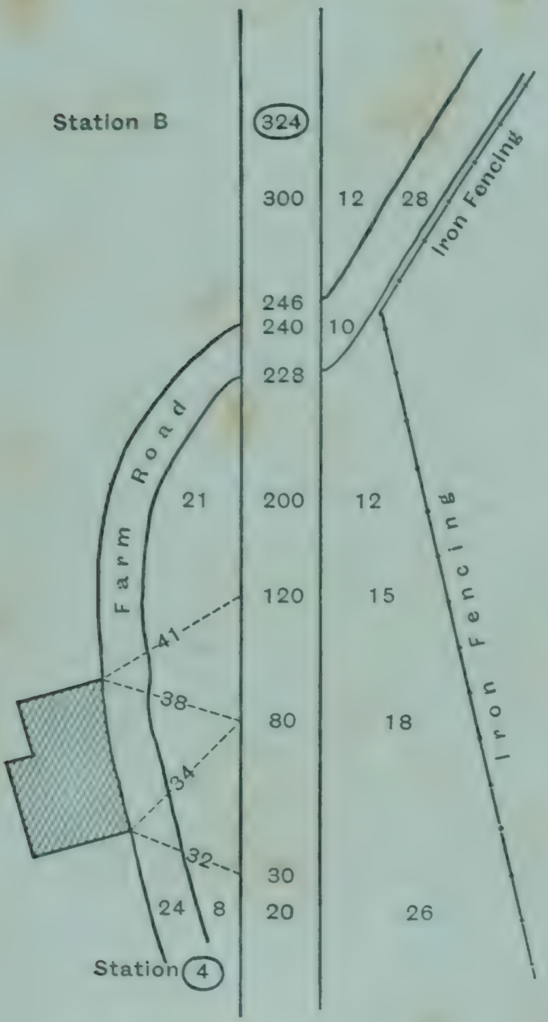


Fig. 401.—Specimen of Field Book

The Field Book.—When there is any great extent of measuring by chain to be done, a Field Book will be found useful to record the distances, and any important features to the right or to the left of the chain line. A useful size is one about 7 in. by 4½ in., containing about twenty-four leaves. A column about ⅝ in. wide is ruled up the centre, and is intended to correspond with the straight line that is being chained. The entries in the field book commence at the bottom of the page, and from the *end* of the book. Certain leading points along the line to be chained are called "stations", and are marked in the field book with a circle, thus O. The stations may be called A, B, C, D, &c. The distances chained are entered in the central column. At certain distances, however, it may be necessary to note some feature to the right or left of the chain line. Thus, in the specimen page of the field book given here (fig. 401), it will be noticed that at 20 links there is an iron fence 26 links to the right of the chain line, and this iron fence gets as near as 12 links when the straight line has been chained 200 links. In the same way, on the left, the "farm road" is indicated as 8 links to the left, while the corners of a building are shown to be at various distances from the chain line. Although there is a column in the field book it must be regarded as a single line, and not as two distinct ones. Thus, when the farm road crosses from left to right at 228 and 246 links, the lines indicating it appear opposite the point at which they intersected the chain line. In surveying a piece of land, chain lines should be marked out so as to take in the most important features or to form the longest and best base lines. Afterwards the chain lines with their stations and distinctive features can be plotted to scale on paper, and will give a correct idea as to the shape of the land surveyed. The area is then computed by measuring up the triangles or rectangles made by the various chain lines.

Offsets.—The distances to the right or left of a chain line are marked off by means of "offset" staffs, each 10 links (79·2 in.) long. Each link is painted alternately red and white, or black, and numbered; and the bottom end is pointed to stick in the ground. Offset distances are always taken at right angles to the chain line; but those for buildings are taken obliquely for the corners, as shown in the sketch.

LEVELLING

In laying out a garden, or in reducing a piece of undulating ground to the level of a bowling green, cricket pitch, or tennis ground, the art of levelling is a useful accomplishment. A simple method of taking levels, and one usually sufficient for most horticultural and agricultural purposes, is by means of "borning" or "boning" rods and spirit levels. Three boning rods are used, each consisting of a straight piece of smooth batten about 4 ft. long, with a shorter crosspiece on top, the whole resembling the letter T. Sometimes the boning rods are all alike, but there are variations. The crosspiece in some cases is an inch wider than in others, and a small sighting hole is pierced in it just 1 in. from the upper edge. On looking through this hole, and sighting over the second and third rod (each of which is held by an assistant) it

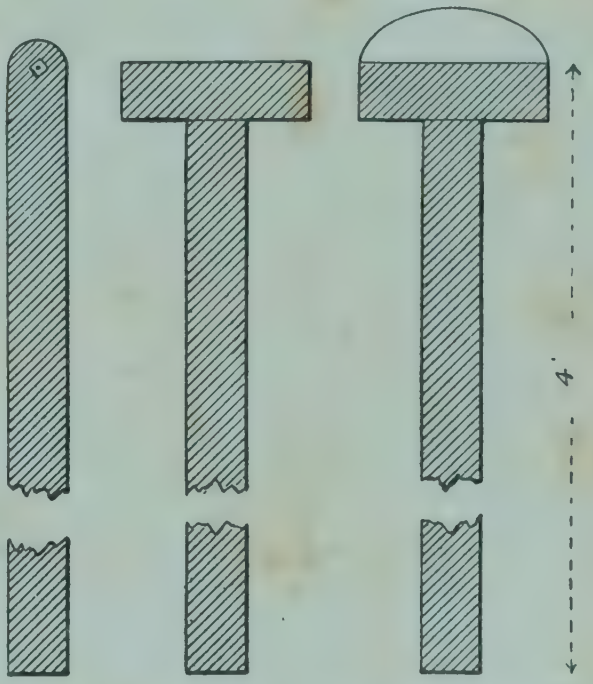


Fig. 402.—Boning Rods

is possible to see whether the third rod is higher or lower than the second one. This latter must be arranged on the same level as the sighting one by means of a spirit level, after which the third rod may be shifted about to various spots. Pegs are driven in at the various points until the tops are at the required level. One can then see at a glance, by the length of the pegs sticking out of the ground, which are the higher and lower places. The diagram (fig. 402), shows another set of boning rods. The sighting hole is in a plain upright rod without a cross piece, while the end rod has a rounded cross piece, with the portion above the proper level painted white. This makes it much easier for the eye to distinguish the edge of the second or intermediate rod when sighting through from the first on to the third.

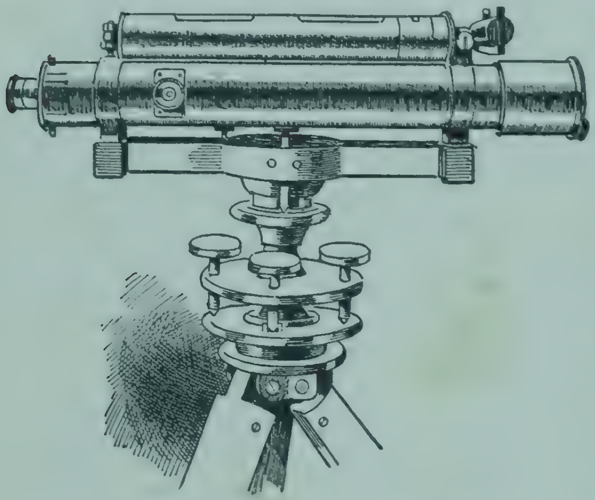


Fig. 403.—Dumpy Level

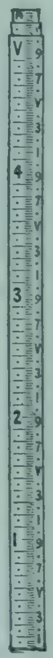


Fig. 404.—Levelling Rod

The Dumpy Level.—For more accurate work an instrument called the "dumpy level" (fig. 403) is useful. It consists of a telescope mounted on a tripod stand, and can be moved about in all directions. Attached to the telescope is a delicate spirit level and often a ring compass. The telescope is adjusted properly when the bubble in the spirit level is exactly in the centre when the telescope is turned backwards and forwards, and when the cross hairs on the lens are distinctly seen. The attached level is then said to be parallel to the "line of collimation" of the telescope.

In using the Dumpy level the tripod is fixed firmly on the ground and the operator looks through the telescope on to the levelling rod placed on a certain spot. The levelling rod (fig. 404), varies in height up to 14 and 18 ft., and has three pieces which may be drawn out if necessary. It is divided into feet and decimals of a foot as shown. The feet are shown in red figures, the odd numbers of the foot decimals in black figures, while the hundreds are shown by black and white lines alternately.

In simple levelling the dumpy level remains in one position, from which all readings are taken. The first reading is called the "back sight" and the last the "fore sight". The difference in the readings of the back sight and fore sight is equal to the difference of level of the two points. Thus, if the back sight is read as 9·50 ft. and the fore sight at 13·75 ft. there is a fall from the back-sight point to the fore sight of 4·25 ft.

Where, however, the ground is of an irregular nature it may be necessary to take several levels. These should be entered up in a field book divided into columns as shown below.

In the diagram (fig. 405) the stations are marked from A to G, and the sightings are taken from the dumpy level midway between the stations. Thus by sighting on to A the hair line intersects the rod at 3 ft. from the ground. This figure is put in the back-sight column. Then, looking on to shaft B, it is found to intersect at 5 ft. from the ground. This figure is entered in the fore-sight column. The instrument is then moved midway between stations B and C, and B now becomes a back sight, and C the fore sight. The figures recorded respectively are 2 ft. and 5 ft. 6 in. In the same way the instrument is moved midway between the other stations, and the figures for back sights and fore sights are recorded as shown in the following table:—

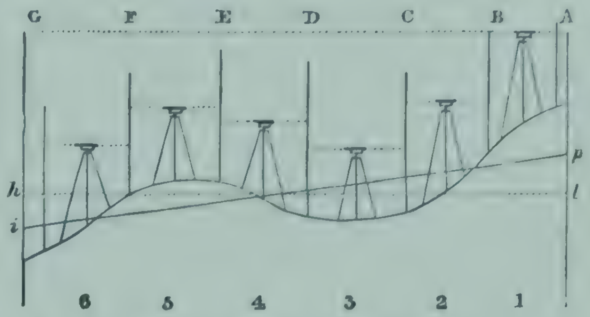


Fig. 405.—Diagram showing how Flying Levels are taken between various points

Stations.	Distance.	Back Sights.		Fore Sights.		Rise.		Fall.		Reduced Level.	
	ft.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
A	—	—		—		—		—		—	
B	50	3	0	5	0	—		2	0	2	0
C	"	2	0	5	6	—		3	6	5	6
D	"	3	6	3	6	—		—		—	
E	"	4	6	3	0	1	6	—		4	0
F	"	4	0	4	6	—		0	6	4	6
G	"	2	6	5	6	—		3	0	7	6
		19	6	27	0	1	6	9	0		
				19	6			1	6		
				7	6			7	6		

The back sight to any station is usually placed on the line below the point to which it refers, hence the back sight for A 3 ft. is placed on the line opposite station B. When a back sight is greater than a fore sight, the difference is placed in the "rise" column; but when less, the difference is placed in the "fall" column. The difference between the sum of the back sight and the sum of the fore sight gives the "reduced level". Thus in the above the reduced level for B is 2 ft. and at C 5 ft. 6 in., because there has been a further fall of 3 ft. 6 in., which must now be added. At D there is nothing to add or subtract, the back sights and fore sights being equal. At E there is a rise of 1 ft. 6 in., and this must be deducted from the previous reduced level of 5 ft. 6 in., thus leaving it at 4 ft. The further falls of 6 in. and 3 ft. must be added, making the reduced level for the whole operation come to 7 ft. 6 in. It will be observed that this is exactly the difference between the total of the back-sight column and the fore-sight column; as it also is the difference between the totals of the "rise" and "fall" columns. If the difference is not identical in each case there is something wrong.

In the diagram it will be noticed that the dotted line *hl* represents the level, and it may be seen that there is just enough ground above this line to fill up the hollows beneath it and thus make the surface perfectly level. If it is desired to lay out ground on an inclined plane, instead of perfectly level, a rod is placed at each end, and one in the middle, as shown at A, G, and D, respectively. The line *ip* will represent the inclined-plane surface, and the point at D being in the middle will remain in the same position on the surface. From the diagram it is obvious that it would not be necessary to move as much soil to fill up the hollows below the line *ip* as it would to fill up beneath *hl*. The levels between A D and D G should be taken in the way already described, making A and D extremities in one case, and D G extremities in the other. In this way a good deal of labour in shifting soil afterwards would be saved, as the hollow places would be indicated by the section in the field book.

In connection with ordinary land surveying for horticultural and agricultural purposes one need not consider such problems as the curvature of the Earth's surface, nor is there any great need for the use of the theodolite and trigonometry, or logarithmic tables.

LAYING OUT LAND AND PLANTING

It often happens that ground is to be laid out in squares, rectangles, &c., of different dimensions, and it may be well to give a few instructions and illustrations.

The Square.—If an acre of land is to be laid out in the form of a square, each side must measure $316\frac{1}{4}$ links of Gunter's chain $= 208\frac{71}{100}$ ft. $= 69\frac{57}{100}$ yd. A popular method of marking out a square acre is to step out 70 paces each way.

The following tables may be useful to show the dimensions of an acre in perches and feet, and also in yards:—

Table showing Breadths and Lengths of a Statute Acre in Perches and Feet

Breadth.	Length.		Breadth.	Length.		Breadth.	Length.	
perch.	perch.	ft.	perch.	perch.	ft.	perch.	perch.	ft.
10	16	0	22	7	$4\frac{1}{2}$	34	4	$11\frac{11}{17}$
11	14	9	23	6	$15\frac{18}{23}$	35	4	$9\frac{3}{7}$
12	13	$5\frac{1}{2}$	24	6	11	36	4	$7\frac{1}{3}$
13	12	$5\frac{1}{13}$	25	6	$6\frac{3}{5}$	37	4	$5\frac{13}{37}$
14	11	$7\frac{1}{14}$	26	6	$2\frac{7}{13}$	38	4	$3\frac{9}{19}$
15	10	11	27	5	$15\frac{1}{8}$	39	4	$1\frac{9}{13}$
16	10	0	28	5	$11\frac{11}{14}$	40	4	0
17	9	$6\frac{27}{34}$	29	5	$8\frac{31}{58}$	41	3	$14\frac{73}{82}$
18	8	$14\frac{2}{3}$	30	5	$5\frac{1}{2}$	42	3	$13\frac{3}{7}$
19	8	$6\frac{18}{19}$	31	5	$2\frac{41}{62}$	43	3	$11\frac{77}{86}$
20	8	0	32	5	0	44	3	$10\frac{1}{2}$
21	7	$10\frac{3}{14}$	33	4	14	45	3	$9\frac{1}{6}$

TABLE SHOWING DIMENSIONS OF A STATUTE ACRE IN YARDS, FROM 1 TO 100 YARDS BY LENGTH

Length.	Width.			Length.	Width.			Length.	Width.			Length	Width		
yd.	yd.	ft.	in.	yd.	yd.	ft.	in.	yd.	yd.	ft.	in.	yd.	yd.	ft.	in.
1	4840	0	0	26	186	0	6	51	94	2	9	76	63	2	1
2	2420	0	0	27	179	0	10	52	93	0	3	77	62	2	7
3	1613	1	0	28	172	2	7	53	91	1	0	78	62	0	2
4	1210	0	0	29	166	2	9	54	89	1	11	79	61	0	10
5	968	0	0	30	161	1	0	55	88	0	0	80	60	1	6
6	806	2	0	31	156	0	5	56	86	1	4	81	59	2	4
7	691	1	4	32	151	0	9	57	84	2	9	82	59	0	1
8	605	0	0	33	146	2	0	58	83	1	5	83	58	1	0
9	537	2	4	34	142	1	1	59	82	0	2	84	57	1	11
10	484	0	0	35	138	0	11	60	80	2	0	85	56	2	10
11	440	0	0	36	134	1	4	61	79	1	1	86	56	0	11
12	403	1	0	37	130	2	6	62	78	0	2	87	55	1	11
13	372	1	0	38	127	1	2	63	76	2	6	88	55	0	0
14	345	2	2	39	124	0	4	64	75	1	11	89	54	1	2
15	322	2	0	40	121	0	0	65	74	1	5	90	53	2	4
16	302	1	6	41	118	0	2	66	73	1	0	91	53	0	7
17	284	2	2	42	115	0	9	67	72	0	9	92	52	1	10
18	268	2	8	43	112	1	9	68	71	0	7	93	52	0	2
19	254	2	3	44	110	0	0	69	70	0	6	94	51	1	6
20	242	0	0	45	107	1	8	70	69	0	5	95	50	2	11
21	230	1	6	46	105	0	8	71	68	0	7	96	50	1	3
22	220	0	0	47	103	0	0	72	67	0	8	97	49	2	9
23	210	1	4	48	100	2	6	73	66	0	11	98	49	1	2
24	201	2	0	49	98	2	4	74	65	1	3	99	48	2	8
25	193	1	10	50	96	2	5	75	64	1	8	100	48	1	3

TABLE SHOWING THE NUMBER OF PLANTS, TREES, OR SHRUBS TO 1 STATUTE ACRE PLANTED FROM 1 FT. TO 30 FT. APART

Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.	Distance in Feet.	Number.
1	43,560	6½	1031	12	302	17½	142
1½	19,360	7	889	12½	270	18	134
2	10,890	7½	774	13	257	18½	127
2½	6,970	8	680	13½	239	19	120
3	4,840	8½	603	14	222	19½	114
3½	3,556	9	537	14½	207	20	108
4	2,722	9½	482	15	193	22	90
4½	2,151	10	435	15½	181	24	75
5	1,742	10½	395	16	170	26	64
5½	1,440	11	360	16½	164	28	55
6	1,210	11½	329	17	150	30	48

To obtain the number of plants to a square rod, pole, or perch at the above distances apart, divide the number of plants by 160, and the quotient will be the desired number. Thus $\frac{10890}{160} = 68$ plants to 1 rod.

TABLE SHOWING NUMBER OF PLANTS, AT GIVEN DISTANCES, CONTAINED IN A SQUARE ROD, POLE, OR PERCH

Inches apart.	No. of Plants.	Inches apart.	No. of Plants.
3 × 3	4356	8 × 8	612
4 × 4	2450	10 × 8	490
5 × 4	1960	10 × 10	392
6 × 4	1633	12 × 12	272
6 × 6	1089	15 × 10	261
8 × 6	816		

By multiplying the number of plants to a square rod by 160 the number per acre is obtained.

TABLE SHOWING NUMBER OF PLANTS CONTAINED IN 1 ACRE OF LAND AT DIFFERENT DISTANCES APART

Inches apart.	No. of Plants.	Inches apart.	No. of Plants.
30 × 12	17,424	30 × 30	6,969
30 × 18	11,616	30 × 36	5,808
30 × 24	8,712	30 × 42	4,978

The Rectangle.—If it is desired to lay out an acre of ground in the form of a rectangle, the area is divided by the length of one side to ascertain the other. Thus an acre of land = 4840 sq. yd. = 160 sq. poles = 10 sq. chains. A rectangle may be obtained by having sides 88 yd. × 55 yd., by 16 poles × 10 poles, or by 5 chains × 2 chains.

If the length of a rectangle is to be a certain number of times the width, the following rule will serve: *Divide the area by the ratio of length to the width, and the square root of the quotient will be the shorter side required: whence the longer is also known.* If it is desired to lay out 30 ac. in the form of a rectangle three times as long as broad, proceed thus: 30 ac. = 300 sq. chains. Divide the ratio of length = $\frac{300}{3}$ = 100 sq. chains. Extract the square root: $\sqrt[2]{100}$ = 10 chains. Then the rectangle will be 10 chains wide and 30 chains long.

The following table relating to the proportions of a circle, and its equal and inscribed square, will prove useful in calculations:—

1. Diameter of a circle	× ·8862	=	side of an equal square.
2. Circumference of a circle	× ·2821		
3. Diameter of a circle	× ·7071	=	side of an inscribed square.
4. Circumference of a circle	× ·2251		
5. Area of a circle	× ·6366		
6. Side of inscribed square	× 1·414	=	diameter of a circumscribed circle.
7. " "	× 4·443	=	circumference of an equal circle.
8. " a square	× 1·128	=	diameter of an equal circle.
9. " "	× 3·545	=	circumference of an equal circle.

From this table one may describe any square or circle of equal dimensions.

Circles.—The diameter of any circle being known, the circumference is obtained by multiplying it by 3·1416 or $\frac{22}{7}$. Thus, a circle with a diameter of 12 in. would have a circumference of 37·6992 in. The *radius* of a circle is half the diameter. The *area* of a circle is obtained either (1) by squaring the diameter and multiplying by ·7854 or (2) by multiplying the square of the radius by 3·1416. The following are useful formulæ relating to the circle:—

Circumference of circle × ·3183 = diameter.
,, ,, × ·15915 = radius.
,, ,, × 1·2732 = square of diameter.
,, ,, × 12·5663 = square of the circumference.
,, ,, × ·2756 = side of an inscribed equilateral triangle.
,, ,, ÷ 3·1416 = diameter.
,, ,, ÷ 6·2831 = radius.

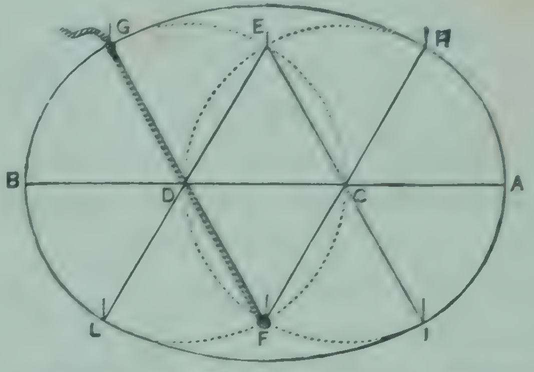


Fig. 406.—Showing how an Oval Bed is struck from 2 circles, and how the intervening space may be filled in

Oval, Ellipse.—These are two common shapes for flower beds in gardens. The methods used for striking ovals and ellipses in gardens are shown in the accompanying diagrams (figs. 406, 407). In the first one it will be seen that two intersecting circles are made, one with the centre at D, the other at C—both equal. The gap between the two is filled in by freehand. To find the *area* of an ellipse multiply the long axis by the short axis, and the product by ·7854. The same result may be secured by multiplying half the long or main axis by half the short axis, and the product by 3·1416.

Having decided on the length of an elliptical bed, the most simple method of striking the figure is to fix two pegs at equal distances in from the ends of the long axis. Then make a string loop equal to the entire length of the long axis and place to enclose the two pegs. By stretching the loop tightly with a pointed stick, and working right round from one end of the long axis to the starting point, the form of an ellipse may be traced on the ground.

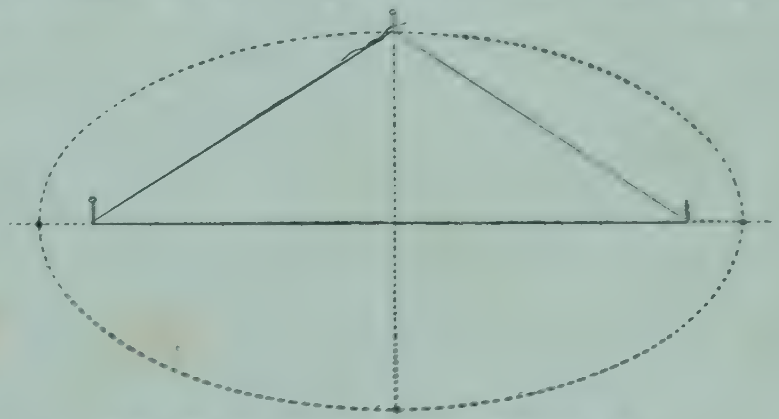


Fig. 407.—Showing how to make an Elliptical Bed

Cone.—The area equals half the product of the circumference of base multiplied by the slant height. *Example*: The radius of the base of a cone is 8 in. and the slant height 14 in. Circumference of base = 2 × 8 × 3·1416 = 50·2656; and area = $\frac{1}{2}$ × 14 × 50·2656 = 351·8592 sq. in.

The rule for finding the area of the surface of a cone may be used for estimating the approximate extent of the leaf surface of many kinds of trees, shrubs, and bushes, which are often conical in shape. Thus a tree or bush having a spread of 10 ft. across the base of the branches, and a slant height of 10 ft. from base to apex, would have an approximate leaf surface of $\frac{10 \times 3{\cdot}1416 \times 10}{2} = 157{\cdot}08$ sq. ft.

Most flower pots are cones with the ends cut off—in other words, a flower pot is a *frustum* of a cone. To find the area of the curved surface of a flower pot, *multiply the sum of the circumferences of the two ends of the flower pot (frustum) by the slant height of the pot (frustum), and half the product will be the area of the curved surface.*

Example: The radius of the bottom or narrow end of a flower pot is 10 in., and the radius of the top or broad end is 15 in.; the slant height is 16 in. Find the area of the curved surface.

The sum of the circumferences in inches is the product of 3·1416 into the sum of 20 and 30, i.e. into 50. Thus the sum of the circumferences is 50 × 3·1416 in. Multiply this sum by the slant height, 16, and divide by 2, thus: $\frac{16 \times 50 \times 3{\cdot}1416}{2} = 8 \times 50 \times 3{\cdot}1416 = 400 \times 3{\cdot}1416 = 1256{\cdot}64$ sq. in.

Cylinder.—Hot-water pipes and water cans being really cylinders, it is useful to know their surface areas as well as contents. To find the area of a curved surface of a circular cylinder (like a piece of piping), the rule is to *multiply the circumference of the base by the height of the cylinder.* It may be remarked that a cylinder is really a rectangle rolled up till its two long edges meet. Thus, if a piece of hot-water pipe is 4 in. in diameter and 3 ft. (36 in.) long, the area of its curved surface will be 4 × 3·1416 × 36 = 452·39 sq. in. It is thus easy to find the heat surface of the piping in any greenhouse by means of this rule. The curved surface of a water can may be found in the same way.

Where, however, it is necessary to know not only the area of the curved surface, but also that of the two ends, the latter is found by the rule for finding the area of a circle (see above). The whole surface of a cylinder, therefore, equals the area of the two ends plus the length multiplied by the circumference.

Sphere or Globe.—The surface area is found by multiplying the square of the diameter by 3·1416. Thus a globular bush 5 ft. through has a superficial area of 5 × 5 × 3·1416 = 78·54 sq. ft.

Triangles.—The ends of greenhouses and the gable ends of houses, sheds, &c., from the eaves up, are examples of triangles. To find the area of a triangle the rule is to *multiply the base by half the perpendicular height*; or the other way round—*half the base by the perpendicular height*

—comes to the same thing. Thus if a triangle has a base of 9 ft. and a height of $4\frac{1}{2}$ ft., the area may be found either by $\frac{9 \times 4\frac{1}{2}}{2} = \frac{9 \times 9}{2 \times 2} = 20\frac{1}{4}$ sq. ft; or $\frac{9}{2} \times 4\frac{1}{2} = \frac{9}{2} \times \frac{9}{2} = 20\frac{1}{4}$ sq. ft. A somewhat more complicated problem is to find the area of a triangle from the given lengths of the three sides. The rule is: *From half the sum of the three sides subtract each side separately; multiply the half sum and the three remainders together; the square root of the product will be the area. Example*: The sides of a triangle are 26 in., 28 in., and 30 in. respectively. The sum of these is $26 + 28 + 30 = 84$. Half the sum is $\frac{84}{2} = 42$. From this subtract each side separately: $42 - 26 = 16$; $42 - 28 = 14$; $42 - 30 = 12$. Multiply half the sum and the three remainders together, thus: $42 \times 16 \times 14 \times 12 = 112{,}896$. The square root of 112,896 is the area of the triangle, viz. 336 sq. in.

The area of an equilateral triangle is readily found by multiplying one side by ·433.

From these examples it will be easy to find the total area of the end of a greenhouse or building by adding the area of the rectangular portion to the area of the triangular portion.

Other Figures.—The area of a *rhombus* equals half the product of the two diagonals. The area of a *trapezoid* equals half the sum of two parallel sides by the perpendicular distance between them.

The area of a *trapezium* equals the longest diagonal by half the sum of the two perpendiculars falling upon it from the opposite angles.

The area of any irregular four-sided figure with straight sides may be found by dividing it into triangles. Find the area of each triangle separately and add together.

Volumes.—The volume or cubic contents of any body is found by solid or cubic measure, a practical knowledge of which is most useful to commercial gardeners. Before proceeding to give examples, the following tables may be noted:—

1 cub. ft. = 1728 cub. in.
27 cub. ft. = 1 cub. yd. = 46,656 cub. in.
1 cub. ft. of water = 1000 oz. avoir. (really 997·137 oz.) = 62·5 lb.
1 pt. of pure water weighs $1\frac{1}{4}$ lb.
1 gal. of water = 10 lb. = 277 cub. in.

oz.	cub. in.	gill.	pt.	qt.	gal.	pk.	bush.	qr.
5	8·664	1						
20	34·659	4	1					
40	69·318	8	2	1				
160	277·274	32	8	4	1			
320	554·548	64	16	8	2	1		
1,280	2218·192	256	64	32	8	4	1	
10,240	17745·536	2048	512	256	64	32	8	1

Thus, to find the cubic contents of any square or rectangular solid body, the length, width, and depth are multiplied together. Thus, 1 cub. ft. = 12 in. by 12 in. by 12 in. = 1728 cub. in.

An acre of soil contains 43,560 sq. ft., and at 1 ft. deep is considered to weigh on an average 3,000,000 lb. Therefore 1 cub. ft. of soil weighs on an average $\frac{3{,}000{,}000}{43{,}560}$ = 69 lb., nearly. 1 cub. yd. of soil weighs about 1863 lb. = 16·6 cwt. In practice it is reckoned as 1 ton.

In applying these figures to well-known things in gardens and nurseries the following examples may be taken.

Water tanks.—In square-built tanks the length by width by depth equals cubic contents. Each cubic foot by 6¼ equals number of gallons in tank. Thus a tank measuring 6 ft. long, 3 ft. wide, and 4 ft. deep contains 72 cub. ft., and 72 × 6¼ = 450 gal. = 4500 lb.

The following table gives the more exact number of gallons in square tanks, according to their dimensions—1 gal. of water being reckoned at 6·232 lb.:—

NUMBER OF GALLONS IN SQUARE-BUILT TANKS

SIZE OF TANK.	DEPTH IN FEET.			SIZE OF TANK.	DEPTH IN FEET.		
Feet.	3 ft.	4 ft.	5 ft.	Feet.	3 ft.	4 ft.	5 ft.
6 by 3	336	448	560	10 by 6	1121	1495	1869
6 ,, 4	448	598	747	10 ,, 7	1308	1744	2181
6 ,, 5	560	747	934	10 ,, 8	1495	1994	2492
6 ,, 6	673	897	1121	10 ,, 9	1682	2243	2804
7 ,, 4	523	698	870	10 ,, 10	1869	2492	3116
7 ,, 5	654	872	1090	11 ,, 6	1233	1645	2056
7 ,, 6	785	1047	1308	11 ,, 7	1439	1919	2399
7 ,, 7	916	1221	1526	11 ,, 8	1645	2193	2742
8 ,, 4	598	797	997	11 ,, 9	1850	2467	3084
8 ,, 5	747	997	1246	11 ,, 10	2056	2742	3427
8 ,, 6	897	1196	1495	11 ,, 11	2262	3016	3770
8 ,, 7	1046	1395	1744	12 ,, 6	1346	1794	2243
8 ,, 8	1196	1595	1994	12 ,, 7	1570	2093	2617
9 ,, 5	841	1121	1402	12 ,, 8	1794	2393	2991
9 ,, 6	1009	1346	1682	12 ,, 9	2019	2692	3365
9 ,, 7	1177	1570	1963	12 ,, 10	2243	2991	3739
9 ,, 8	1346	1794	2243	12 ,, 11	2467	3290	4113
9 ,, 9	1514	2019	2523	12 ,, 12	2692	3589	4487
10 ,, 5	934	1246	1558				

To find the contents in gallons of circular tanks or wells it is necessary to square the diameter, multiply by the depth, and then multiply the result by 4·8947. Thus, a circular tank with a diameter of 4 ft. and a depth of 3 ft. would be measured thus: The diameter squared = 4 × 4 = 16. This multiplied by the depth = 16 × 3 = 48; and 48 × 4·8947 = 234·946 or say 235 gal.

The volume in cubic feet of a cylindrical tank, prism, or parallelepiped equals area of the base by height or depth. The area of the base equals the diameter squared × ·7854. Therefore the volume of a circular tank with a diameter of 4 ft. and a depth of 3 ft. is found thus: Area of base = 4 × 4 × ·7854 = 12·5664 sq. ft. Volume = 12·5664 sq. ft. × 3 ft. = 37·6992 cub. ft. Reckoning each cubic foot equals 6¼ gal. of water, the number of gallons in the tank = 37·6992 × 6·25 = 236·62 gal. The following table gives the number of gallons contained in circular tanks or wells of various dimensions:—

NUMBER OF GALLONS IN CIRCULAR TANKS AND WELLS

DIAMETER.	WHEN THE DEPTH IS									
Feet.	3 ft.	4 ft.	5 ft.	6 ft.	7 ft.	8 ft.	9 ft.	10 ft.	11 ft.	12 ft.
4	235	313	391	469	548	626	704	783	861	939
5	367	489	611	734	856	979	1101	1223	1346	1468
6	528	704	881	1057	1233	1409	1585	1762	1938	2114
7	719	959	1199	1439	1678	1918	2158	2398	2638	2878
8	939	1253	1566	1879	2192	2506	2819	3132	3445	3759
9	1189	1585	1982	2378	2775	3171	3568	3964	4361	4757
10	1468	1957	2447	2936	3426	3915	4405	4894	5384	5873
11	1776	2368	2961	3553	4145	4737	5330	5922	6514	7107
12	2114	2812	3524	4229	4933	5638	6343	7048	7753	8458

The contents in cubic feet and gallons may be found in the same way with water pots and hot-water pipes. Thus, a yard of 4-in. hot-water pipe contains 4 × 4 × ·7854 = 12·5664 sq. in., the volume is 12·5664 × 36 = 452·3904 cub. in., and the water contained is something over 13 pt. Every foot run of 4-in. pipe holds ·544 gal. of water weighing 5·44 lb.

Flower Pots.—It is a little more complicated to gauge the cubic contents of these accurately, because they are not cylindrical, square, or rectangular bodies, but truncated cones—broader at the top than at the bottom. The volume of any flower pot may be found by the following rule: *To the areas of the two ends add the square root of their product, multiply the sum by the height of the pot, and one-third of the product will be the volume.* Taking a 5-in. or 48-sized pot, which is probably the most largely used size in the trade, the dimensions are: Top width 5 in., bottom width 3 in., depth 4½ in. To find volume proceed as follows: Area of top 5 × 5 × ·7854 = 19·6 sq. in.; area of bottom 3 × 3 × ·7854 = 7 sq. in. Product of areas = 19·6 × 7 = 137·2. Square root of 137 = 11·7. Add square root to areas of top and bottom, 19·6 + 7 + 11·7 = 38. Multiply by depth, 4½ = 38 × 4½ = 171. Divide by 3 = $\frac{171}{3}$ = 57 cub. in., the required contents of a 5-in. pot—equivalent to 1·64 pt. of water.

In the same way it may be found that the cubic contents of a 6-in. or 33-sized pot is about 108 cub. in.—equivalent to 3·11 pt. of water.

With the help of this rule it is easy to estimate the quantities of soil or compost required for any particular crop. For instance, if 10,000 Zonal Pelargoniums are to be placed in 5-in. pots (48's), this will mean 570,000 cub. in. of soil = 329 cub. ft. = 12 cub. yd. = about 12 tons.

SECTION XXIX

Market-garden Accounts

There is a general impression that market gardeners and market growers generally do not worry themselves much in the matter of keeping strict account of their financial transactions. This impression may be correct so far as some of the older school of market growers is concerned, but we doubt if there are many modern commercial horticulturists who do not keep a fairly strict account of their business transactions.

There are undoubtedly some men to be found who treat the subject of keeping accounts with the utmost disdain, and such cannot be brought to see that it is essential to know exactly how their business stands. They take their goods to market, and so long as what is taken for them is entered up in a pocket book, that is all that matters. Any surplus cash is paid into the bank, but payments for all kinds of things are made out of the cash takings without any account being kept. Memory is trusted to very largely, but it is no real evidence that any certain transactions have taken place should they be at any time questioned. Besides, as one grows older, the memory loses its sensitiveness, and important business transactions may be easily forgotten, or the details of them may become so obscure as to make it impossible to arrive at a correct result.

It is therefore of the greatest importance that an account should be kept of all commercial transactions, and that a system of bookkeeping should be adopted to suit the special requirements of the business. Some growers will have one system and some another, but they must all be founded on the fundamental principles of debit and credit—of buying and selling, of giving and receiving. In business, if a man *gives* something, he expects to *receive* something for it in return, either in money or goods, and as the essence of all business is to make a *profit*, he always endeavours to secure a higher amount for an article than it has cost him to produce. Thus, a man who grows, say, 100 tons of Tomatoes every year hopes to receive more money for them than it has actually cost to grow them. He must receive a price sufficiently high to pay for his labour, coal or coke, rent, rates, taxes, water, interest on capital, and depreciation, in addition to which there must be something over for the benefit of himself and his family. If he secures a price to meet all these demands he makes *a profit*; but if he fails to do so, then he makes *a loss*, and he must make this loss good from some other source, if available.

Men who are careless over their bookkeeping arrangements not infrequently come to financial grief. Even if they do not reach the bankruptcy court, they are always in such a muddle with their affairs that they are continually having overdrafts at the bank, for which, of course, "charges" are inevitably made, because banks must make a profit on money in the same way that a grower must make a profit on Tomatoes or Cabbages.

Speaking generally, it will be found a wise plan, whether the business be large or small, to keep a strict account of all moneys received and paid away, and what they are received and paid away for. If the business is too large for the owner, or one of his family, to keep his accounts, probably, then, one or more clerks who have had a horticultural training or experience should be engaged at a fair wage to attend to them properly. The employer will indicate the lines on which he wishes his accounts to be kept, and the more simple the system he adopts the better. He should arrange the system in such a way that the details of any particular branch of the business can be analysed in a few minutes. He will then be in a position to ascertain whether any particular crop is "paying its way", whether there is a loss on it, or whether it is in such an evenly balanced condition that there is neither profit nor loss. Having discovered exactly how matters stand, the wise grower will soon "cut his losses", and devote his energies to developing the branch or branches that his accounts and analyses show to be paying him best.

One can almost fancy some of the old-fashioned market growers exclaiming: "What nonsense all this is about keeping accounts with clerks, and having analyses made out! My father and grandfather never did anything of the sort, and why should I? My bank book is all the book-keeping I want to do!" This is the spirit that eventually leads some growers to the bankruptcy court, where they sorrowfully state that they really don't know how they stand, because they "never kept any accounts". What did for father and grandfather in the old non-competitive days will not do in these days of keen competition, hustling, and scientific developments.

Even if a business is only a small one, the owner of it will do well to keep a strict account of its progress or the reverse. If progress, then a feeling of satisfaction prevails, and a man realizes that his system of conducting business is at least on the right lines. If no progress is made, then he must alter his methods, but before doing this he must be able to put his finger on the weak spot which is responsible for his losses. The beginner must always be careful how he goes to work, and he must not assume, because his neighbour Mr. A. is making a good living by growing certain crops, that he also will achieve the same result without any trouble or organizing ability. He must weigh matters up carefully, and draw up estimates as accurately as he can forecast of his probable receipts and expenses, being careful to put down impartially all essential items of expenditure in detail. He can then survey the field of operations and decide whether it is worth while risking his capital, or whether it is better to work for someone else.

ON STARTING THE MARKET GARDEN

Let us assume that a man contemplates starting a market garden on a small scale, and that he intends to grow Apples, Pears, Plums, Gooseberries, Currants, Raspberries, vegetables of various kinds, and Mushrooms, also bedding stuff, Chrysanthemums, Cucumbers, Tomatoes, and bulbous plants under glass, with catch crops of various things between.

Having made up his mind what he intends to do, he must find the necessary land. He then has to consider whether it will be better to purchase an established garden, or to make a fair start and carry out his own views on an open and suitable piece of ground, well situated so far as railway facilities, &c., are concerned. If a young man, it will be wiser to start his market garden on modern principles rather than hamper himself with an oldfashioned and perhaps tumbledown place. If, however, he should meet with a fairly recently established market garden, with fruit trees and bushes properly planted at reasonable distances apart, and, if the glass structures have wide panes of glass and not too much heavy timber, good boilers and piping, it may be wise to invest in such a place. As a rule it is unwise to take over very old gardens with worn-out trees and bushes, as such a place can never be brought up to date except by completely grubbing up and replanting. This would cost an enormous amount of money, besides which it might be prohibited by the terms of lease, which in most cases have been drawn entirely in the interests of the ground landlord and to the distinct disadvantage of the tenant, chiefly owing to the intense ignorance of horticultural practice on the part of the legal advisers.

Assuming that a market garden such as we have described is to be started from the beginning, unhampered with legal restrictions as to the number of fruit trees or bushes that must be planted to the acre, and untrammelled with any predecessors' errors, the following estimate as to capital outlay will be found approximately correct:—

TABLE I.—ESTIMATE AS TO THE APPROXIMATE COST OF ESTABLISHING A FREEHOLD MARKET GARDEN OF 10 ACRES.

	£	s.	d.
Purchase of 10 ac. freehold land at £50	500	0	0
Dwelling house and offices	500	0	0
Packing shed, stables, &c.	150	0	0
2 horses and harness at £40	80	0	0
1 large wagon	40	0	0
1 small wagon	20	0	0
Spades, forks, hoes, dibbers, rakes, wheelbarrows, ploughs	25	0	0
Fencing	500	0	0
8 greenhouses, 100 ft. by 12 ft., and piping ...	1000	0	0
Miscellaneous	100	0	0
Total	2915	0	0

The total initial cost of establishing a freehold market garden of 10 ac. may be thus about £3000. The question of fencing is important. If the site selected is not already properly protected by walls or hedges it will be necessary to spend a large sum in fencing material. If this can be saved, of course, so much the better. In any case we will assume that £3000 is necessary to make a start. Then comes the question of annual expenses, which may be stated as follows:—

TABLE II.—ESTIMATE SHOWING THE APPROXIMATE ANNUAL EXPENSES OF WORKING A FREEHOLD MARKET GARDEN OF 10 ACRES.

	£	*s.*	*d.*
Rates, taxes, and insurance	25	0	0
Labour—			
1 foreman at 30*s.* per week	78	0	0
3 gardeners at 25*s.* „ each	195	0	0
2 carters at 25*s.* „ „	130	0	0
3 women or girls at 10*s.*	78	0	0
3 boys at 10*s.*	78	0	0
Keep for 2 horses at 30*s.* weekly	78	0	0
Manure, 200 tons at 5*s.* per ton	50	0	0
Depreciation on buildings, houses, horses, vans, &c.	60	0	0
Household expenses	200	0	0
Interest on £3000 capital at 5 per cent	150	0	0
Seeds, bulbs, and miscellaneous	150	0	0
Coal or coke	60	0	0
Total	1332	0	0

Thus the first year the market gardener will have to find about £3000 for capital expenses, £1330 for current expenses, making £4330 altogether. This is a large sum of money, but if well spent he should get some of it back from the sale of produce, such as vegetables, Cucumbers, Tomatoes, flowers. Fruit cannot be expected to yield an appreciable income for the first five years. The ground, however, between the fruit trees and bushes, if well cultivated and stocked with greenstuff, hardy flowers, &c., will not remain altogether unproductive, and it would be safe to assume that 9 ac. out of the 10 would yield an average gross return of 10*s.* per rod—that is to say, 1440 rods at 10*s.* per rod would yield about £720 per annum for the first five years. To this sum must be added the receipts from Tomatoes, Cucumbers, Chrysanthemums, and bedding stuff grown under glass, which may be put down at another £500, making a total revenue of £1220 per annum against an expenditure of £1330, which, however, includes £200 for household expenses.

It may be better to assume, however, that the 10-ac. market garden has been worked properly for the first six or seven years at an annual cost of £1330, and that the fruit trees and bushes are now in a progressive bearing condition, and yielding more and more fruit year after year.

After ten years' cultivation the annual receipts may be estimated as follows:—

TABLE III.—ESTIMATE OF THE APPROXIMATE ANNUAL RECEIPTS FROM A MIXED MARKET GARDEN OF 10 ACRES, ESTABLISHED 10 YEARS

	£	s.	d.
2 ac. half-standard Apple trees, 160 to acre = 320 trees at 15*s*. each	240	0	0
2 ac. bush Apple trees, 300 to the acre = 600 trees at 8*s*. each...	240	0	0
3 ac. bush Plums and Pyramid Pears, 300 to acre = 900 trees at 8*s*. each	360	0	0
3000 Gooseberry bushes, between 2 ac. half-standard Apple trees, at 1*s*. each	150	0	0
1500 Currant bushes, between 2 ac. bush Apple trees, at 2*s*. each	150	0	0
3000 Raspberry stools, between 3 ac. of Plums and Pears, at 1*s*. each	150	0	0
4 houses Cucumbers, 2000 doz. fruits at 1*s*. 6*d*.	150	0	0
4 houses Tomatoes, 2000 plants with 10,000 lb. fruit	125	0	0
Bedding stuff, Chrysanthemums, bulbs, hardy flowers, Mushrooms, &c.	250	0	0
2 ac. vegetables at 10*s*. per rod	160	0	0
Total receipts	1975	0	0

Assuming that the expenses each year are £1332, as stated in Table II, it will be seen that as time goes on the net profits rise up to £643 per annum. It must of course be understood that these figures are only estimates, and are subject to fluctuation one way or the other. The fluctuations, however, are more likely to be on the receipt side than on the expense side. The latter one is always fairly certain about, and such items as labour, manure, horse keep, rates and taxes, &c., are definite in character. If the cultivator could only be as sure of the receipts from the items given on the revenue side he would have no objection to spending the money to earn it. Unfortunately, however, he has no control over the spring frosts, which may reduce his anticipated return of £1290 from 1820 fruit trees and 7500 Gooseberry, Currant, and Raspberry bushes to the odd £290, thus ensuring a dead loss of £1000 on these crops alone in some seasons. It is, however, only by making these estimates of receipts and expenses as accurately as possible on paper that the intelligent cultivator is enabled to see the possibilities for gain or loss in his particular business. The writer is well aware that some growers realize far better prices than are given in the tables above; but, on the other hand, there are also many who never realize them, chiefly because they are unable or afraid to spend a sufficient amount in cultivation.

The crops given in the table are merely for the purposes of illustration, and to show how similar estimates may be prepared for other crops. Thus, growers of Palms, Ferns, Liliums, Aspidistras, Crotons and Dracænas, Carnations, Grapes, and a host of other plants referred to in this work may all be treated in a similar manner.

ACCOUNT BOOKS

There are now all kinds of books—simple and otherwise—on the market with the object of enabling any tradesman to keep an accurate record of his business. Amongst the larger growers of flowers, fruits, vegetables, and plants for market, the system of bookkeeping is much the same as in other commercial undertakings. Day books, cash books, journals, ledgers, &c., are carefully kept, each firm having its own system of analysing and classifying its accounts. Many cultivators, however, have no need of an elaborate system, nor a large staff of clerks to keep their accounts. And this applies, perhaps, more especially to those who grow chiefly for market, and who do a purely cash trade. Even with these tradesmen it is wise to have some set of books to keep their business in order.

The Market Book.—Almost everyone who goes to market makes out a list of the goods he is taking or sending up, stating the exact quantities of each. This information is generally in a narrow book that fits easily into the breast pocket, and is always ready for use. The goods taken to market are entered on the left-hand side, and the sales are entered on the right-hand side on each market day. The prices recorded vary a good deal even for the same article on the same morning. Those recorded at first are better than those near the close of the market, as it is well known that the best buyers and the best payers are always amongst the earliest customers; whereas the "costers", who come later, are always on the lookout for bargains, and endeavour to get produce as cheaply as possible. They clear up what the trade does not require.

In sending goods to market the grower would do well to check the quantities sent with those recorded in the book, as it is not unknown that some employees engaged to help as salesmen occasionally forget to enter up *all* the goods taken to market. They are, however, sold in due course, and the cash received may not always find its way to the employer's pocket through some accident or another. Where the grower attends to these details himself he is placing temptation out of the way of others, and at the same time his receipts will be in accordance with the supplies of stuff marketed.

If an employee acts as salesman it should be insisted that he should enter up every item sold, and the price obtained for it, at once in the book. When the market is over, or as soon as possible afterwards, the employer should check and initial the accounts and take the cash received.

Some employers are very lax in this respect with their salesmen. Instead of checking and settling up each day, they leave this important matter till the end of the week, when there is probably insufficient time to attend to matters properly. The salesman very often, instead of paying up the cash actually received day by day, *averages* the prices obtained during the week, and pays in on that basis. This is one of the most ludicrous and unbusinesslike arrangements any employer could permit. It is a direct encouragement to pilfering and robbery, and, in not a few cases, those who have been foolish enough to allow such a system to prevail have found themselves in the unpleasant predicament of being much worse off financially than their own salesmen. The "average" system once a week for market takings is not in the interests of the employer. It is not unnatural that the *lowest* prices will be taken each day, and the average of these is what an unscrupulous salesman would unblushingly hand over to his employer.

The market book is of the utmost value to the grower if carefully kept. It shows what goods sell first and best if the items are recorded in rotation, and it gives him a clue to the class of stuff which is mostly in demand. Where these books have been kept for years, they are also of interest to show the difference in prices ruling at one period and another, and also the changes that have taken place in the class of produce sold at the different epochs.

Loose-leaf Books. — Nowadays there are many kinds of loose-leaf account books, and market growers who do not wish to carry a lot of "dead" material about in their pockets would do well to invest in some of the loose-leaf books. Pages that are already out of date may be taken out from time to time and placed in a cover for reference if necessary, and "refills" of fresh paper of the proper size are always obtainable. This kind of pocket account book takes up but little space, and one need not carry about day after day a book containing records twelve months or more old.

When fruits, plants and flowers, and vegetables are grown in sufficiently large quantities for sale, it would be wise to keep a special market book for each group. This will afterwards save trouble in analysing the accounts.

Analysis Book.—Many growers never go beyond the market sales-book and the bank book; consequently they are unable to say whether they are doing well or badly with any particular class of produce. To avoid this it would be well to have a special book in which the sales of the various crops could be analysed and kept distinct from each other; and there should be a separate book for fruits, plants and flowers, and vegetables, if of sufficient importance. By having a week to each page, and the main crops each with a separate column, it will be possible to enter up the receipts in such a way that the totals can be seen at a glance. The following is a suggested form of analysis book for fruits, plants and flowers, and vegetables, each section being kept separate.

FRUIT SALES BOOK

For the Week ending .... 191......

Crops.	Monday.			Tuesday.			Wednesday.			Thursday.			Friday.			Saturday			Total for each Crop Sold during Week.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Apples: (The principal kinds to be specified separately.)																					
Pears: (The principal kinds to be specified separately.)																					
Cherries																					
Plums and Gages: (The principal kinds to be specified separately.)																					
Gooseberries: (The principal kinds to be specified separately.)																					
Currants:																					
Black																					
Red...																					
Raspberries ...																					
Strawberries ...																					
Tomatoes																					
Cucumbers																					
Damsons																					
Peaches																					
Apricots																					
Nectarines																					
Grapes: (Kinds to be specified.)																					
Melons																					
Figs																					
Nuts																					
Miscellaneous ...																					
Total for all Crops sold each day																					

VEGETABLE SALES BOOK

For the Week ending .... 191......

Crops.	Monday.			Tuesday.			Wednesday.			Thursday.			Friday.			Saturday.			Total for each Crop.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Broccoli																					
Cabbages																					
Cauliflowers																					
Coleworts																					
Brussels Sprouts ...																					
Savoys																					
Kale (Borecole) ...																					
Turnips																					
Lettuces																					
Carrots																					
Beetroot																					
Parsnips																					
Broad Beans																					
Dwarf Beans																					
Runner Beans ...																					
Peas																					
Onions																					
Leeks																					
Shallots																					
Celery																					
Spinach																					
Parsley																					
Vegetable Marrows ...																					
Jerusalem Artichokes																					
Globe Artichokes ...																					
Asparagus																					
Endive																					
Radishes																					
Seakale																					
Rhubarb																					
Potatoes																					
Miscellaneous ...																					
Total for all Crops sold each day																					

PLANTS AND FLOWERS SALES BOOK

For the Week ending .. .. 191......

	Monday.			Tuesday.			Wednesday.			Thursday.			Friday.			Saturday.			Total for each Crop.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Chrysanthemums ...																					
Carnations																					
Ferns																					
Zonal Pelargoniums ...																					
Palms																					
Asparagus																					
Liliums																					
"Roots"																					
Bulbous Plants ...																					
Annuals																					
Azaleas																					
Spiræas																					
Dahlias																					
Heaths																					
Roses																					
Shrubs																					
&c. &c. &c.																					
Total for all Crops sold each day																					

The above specimens are suggestions, of course; names of crops may be struck out or added, according to the special class of trade done, each grower arranging the headings to suit his particular business. It will be observed that in the column at the end the receipts for any particular crop can be seen at a glance, either for each day or for the whole week; while the figures at the base would show the trade done in all the produce marketed each day of the week.

A somewhat similar system may be adopted if a grower sends his goods to different markets, if he considers it worth while. Sometimes there is a great difference in the price between one market and another, and it may be useful to have them tabulated for future reference.

In all cases, however, the work should be done systematically day by day. If the books are allowed to remain untouched for a few days, or a week or two, and notes only have been kept on scraps of paper, there is great danger of important items being lost or forgotten, and of course no reliance can be placed on accounts kept in this slovenly haphazard way.

Work, Time, and Wages Books.—In large establishments it will be well to keep books recording the name of each employee and the wages paid to each weekly; and if more elaborate details are wanted the work done may be specified on slips supplied to each—much in the same way as builders, plumbers, and others keep a record of the time occupied and material used by various members of their staff. The following may be taken as a specimen of a Time and Wages Book.

TIME AND WAGES BOOK

Employee.	Rate of Wages.	Days of Week.						Time Worked.	Wages Paid.	Overtime Extra.
		Mon.	Tues.	Wed.	Thur.	Fri.	Sat.			
T. Atkins	20/	1	1	1	1	1	1	6	20/	
J. Brown	25/	1	1	1	0	1	1	5	20/10	
C. Carter	18/	1	1	1	1	1	1	6	18/	
D. Driscoll	30/	1	½	1	½	1	1	5	25/	
E. Farley	20/	0	1	½	½	¾	1	3¾	12/6	
G. Gibbons	20/	1	1	1	1	1	1	6	20/	

In establishments where a few crops are grown in large quantities, either in the open or under glass, it is advisable to keep an account of the cost of working each particular piece of land, or each block of houses —or even of individual houses. Suppose, for example, a grower has twenty large houses devoted to Vines, Cucumbers, Tomatoes, &c., it would be an advantage to record not only the exact crop from each house, what it realized in the market, but to have a corresponding record of the actual cost of working each house during the year. Such information is easily secured by organization; and the adoption of the card system would greatly facilitate the keeping of the records. Each employee could be provided with a card on which would be shown the crops taken from the house each day and each week. The workman would fill in his pa ticular share of the card, and the remainder could be filled in in the office The following suggestions for a weekly card may be useful, it bein understood that each house has a number:—

TOMATO HOUSE, No. 1

For the Week ending .... 191......

	Lb. Picked.	These Particulars to be filled in at Office.		
		Prices obtained.	Fuel used during the week, 8 cwt. @ 20/ per ton = ...	£0 8 0
Monday	100	@ *3d.* = £1 5 0	Wages...	1 5 0
Tuesday	120	@ *2½d.* = 1 5 0		£1 13
Wednesday	130	@ *2d.* = 1 1 8	Sundries	0 10 0
Thursday	110	@ *3d.* = 1 7 6	Total Expenses ...	£2 3 0
Friday	90	@ *3d.* = 1 2 6	Receipts	£7 0 10
Saturday	115	@ *2d.* = 0 19 2	Expenses	2 3 0
Total ...	665	£7 0 10	Balance	£4 17 10
Gardener's Signature, ...			*Clerk's Signature,*	

Space for any special remarks.

Keeping a record something like the above would be no great strain on the workman or the clerk. The former would pick his crop and enter the total on the card each day, and after the Saturday picking, if any, he would sign his card and hand it in at the office to be made up by the clerk. Each week a new card would be issued, the old one being placed away in its box under its proper heading. It could afterwards be referred to at any time.

Balance Sheets.—Besides having Market and Sales Books, and an Analysis Book, it will be found a good plan to have special sheets drawn up to keep a record of the receipts and expenses, either monthly or quarterly. These sheets will show the progress of the business, and by having a column on the receipts and expenses sides for the previous years, it will be possible to see at a glance whether there is any progress made or not. Such a sheet will not only give an epitome of the whole business, but will remind the grower that more attention may have to be paid to some departments of his business than to others. The following will be found a useful form to use from month to month or from quarter to quarter:—

WEEKLY, MONTHLY, OR QUARTERLY STATEMENT AND BALANCE SHEET

JANUARY 1, 1912 TO MARCH 31, 1912

Dr. RECEIPTS

	Estimated Receipts for the Year 1912.			Actual Receipts to Date from Jan. 1.			Actual Receipts corresponding Period last Year.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
To Fruit Crops (as per Sales Book):									
Apples	480	0	0	30	10	0	25	0	0
Pears	200	0	0	28	5	0	32	0	0
Plums	250	0	0	0	0	0	0	0	0
Cherries	100	0	0	0	0	0	0	0	0
Gooseberries	150	0	0	0	0	0	0	0	0
Currants	150	0	0	0	0	0	0	0	0
Raspberries	150	0	0	0	0	0	0	0	0
Strawberries	80	0	0	0	0	0	0	0	0
Grapes	150	0	0	30	5	0	26	10	0
Tomatoes	125	0	0	15	10	0	18	5	0
Cucumbers	150	0	0	18	5	0	20	10	0
Peaches, &c.	50	0	0	0	0	0	0	0	0
By Vegetable Crops (as per Sales Book)	160	0	0	32	0	0	28	15	0
By Plants and Flowers (as per Sales Book	250	0	0	100	0	0	85	0	0
Total	2445	0	0	254	15	0	236	0	0
Balance at Bank, Jan. 1				568	7	6			
Cash in hand, Jan. 1				11	5	0			
				834	7	6			

EXPENSES *Cr.*

	Estimated Expenses for the Year 1912.			Actual Expenses to Date from Jan. 1.			Actual Expenses corresponding Period last Year.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
By Wages	430	0	0	107	5	0	107	10	0
" Manure	50	0	0	13	10	0	12	5	0
" Horses	80	0	0	20	0	0	19	10	0
" Rates, Taxes, &c. ...	25	0	0	6	5	0	6	5	0
" Repairs	60	0	0	40	0	0	33	0	0
" Household	200	0	0	69	10	0	67	5	0
" Interest	150	0	0	37	10	0	37	10	0
" Sundries	150	0	0	37	0	0	38	0	0
Total	1145	0	0	331	0	0	321	5	0
Balance at Bank, March 31				494	4	0			
Cash in hand				9	3	6			
				834	7	6			

By keeping an account in this style there is no necessity to use the ordinary kind of Cash Book. The details may be as elaborate as may be desired if still greater accuracy is required. Thus the items under the "Vegetable Crops" and the "Plants and Flowers" may be extended, so that one may see at a glance whether he is exceeding his estimates or not. By comparing the receipts and expenses for the corresponding period of the previous year, the grower will naturally look into the working of any department that shows a tendency to fall much below what has been done in the past.

Petty Cash Book.—While it is always advisable to pay amounts £1 and upwards by cheque, there are usually many small amounts that ar more conveniently paid in cash. These, however, should be entered i a "Petty Cash Book", the items in which can be totalled up weekly on one side, and, if necessary, they may also be analysed on the other. To keep this book in proper order it would be better to draw a cheque occasionally for "Petty Cash", and enter it on the receipt side with th date of drawing. The items of expenditure being entered on the oth side, and totalled up, will indicate when it becomes necessary to dra another petty-cash cheque. This system is better than retaining a certa amount of cash out of the actual takings at the market, as the remaini cash paid into the bank then does not really represent the total receipt or the volume of business done; and it is an easy matter to forget items that may be paid away in the stress of business. In market, all kind of odds and ends have to be paid for on the nail, such as for returne baskets, &c., and a careful account of these items should be kept in a pocket memorandum book, from which the items may be afterwards transferred to their proper places in the account books.